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REPORTS

FROM

COMMISSIONERS:

FIVE VOLUMES.

—(4.)—

MILITARY TRAINING.

Session

3 *February* —— 21 *March* 1857.

VOL. VI.

1857.

BIBL.
LONDIN.
UNIV.

REPORTS FROM COMMISSIONERS:

1857.

FIVE VOLUMES:—CONTENTS OF THE

FOURTH VOLUME.

N.B.—*THE* Figures *at the* beginning of the line, *correspond with the* N° *at the foot of each* Report; *and the* Figures *at the* end of the line, *refer to the* MS. Paging *of the Volumes arranged for The House of Commons.*

MILITARY TRAINING:

[0.52.] REPORT of the COMMISSIONERS appointed to consider the best Mode of RE-ORGANIZING the SYSTEM for TRAINING OFFICERS for the SCIENTIFIC CORPS, together with an Account of Foreign and other Military Education - - - - - p. 1

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REPORT

OF

THE COMMISSIONERS

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FOR

TRAINING OFFICERS FOR THE SCIENTIFIC CORPS;

TOGETHER WITH

AN ACCOUNT

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Ordered to be printed 20th March 1857.

(57.) [Commons 0.52]

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War Department, Pall Mall,
January 1856.

GENTLEMEN,

LORD PANMURE having appointed you Members of a Commission to consider the best mode of re-organizing the system for training Officers for the Scientific Corps, I am directed by Mr. Monsell to transmit to you the enclosed Memorandum for your guidance, and to request that you will address the Report directly to the Secretary of State for War.

I have the honour to be,
Gentlemen,
Your obedient Servant,
CHARLES HAWKER.

Lieut.-Col. W. Yolland, R.E.
Lieut-Col. Smythe, R.A.
The Rev. W. C. Lake, M.A.

MEMORANDUM,

DEFINING

The Duties of the Commission appointed by the Secretary of State for War to consider various Questions with reference to the Re-organization of the System for Training Officers of the Scientific Corps.

Each Member of the Commission is in possession of a copy of the Rapport sur l'Enseignement de l'Ecole Polytechnique.

That Report is a good model of what such an investigation as they are charged with should be.

It describes the existing system of the Ecole Polytechnique, and gives a history of its growth and of its results.

It recommends definitively certain improvements in that system, and gives with great clearness and minuteness the reasons that have determined the conclusions which have been arrived at.

Copies of the report of the Committee of the House of Commons on Sandhurst, which contains many allusions to the education of the Scientific Corps, are also transmitted.

The Secretary of State for War has already determined that patronage should be altogether abolished, and that admission to the Scientific Corps should be obtained only by a competing examination, and that that examination should be an open one.

His Lordship has determined also that the candidate for this competing examination should be from 17 to 20 years of age, and that the education for the Royal Artillery and Royal Engineers should be common for the first year.

The Commission will start from this point.

They will inform themselves, not only by reading, but also by personal inspection, of the system pursued in the best schools abroad, and will record in their report all such observations and facts as may appear to them of importance with reference to military education.

They will also circulate questions on the subject matter of their inquiry to such persons as are likely to be able to assist them by their knowledge and abilities.

They are authorized to select a gentleman to act as their secretary.

W. Monsell.

REPORT

OF

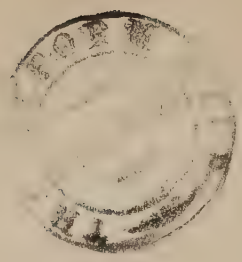
THE COMMISSIONERS

APPOINTED TO CONSIDER

THE BEST MODE OF RE-ORGANIZING THE SYSTEM

FOR

TRAINING OFFICERS FOR THE SCIENTIFIC CORPS.



REPORT AND RECOMMENDATIONS, &c.

To the Right Honourable the Lord Panmure, Secretary of State for War.

My Lord,

Your Lordship having entrusted us with the duty of considering the best mode of re-organizing the Education and Training of Officers of the Scientific Corps, and having directed us, in the course of our inquiry, to inspect the best Military Schools abroad, and to record all observations and facts which might appear of importance with reference to Military Education in general, we beg respectfully to submit to you the course we have taken in following out these instructions, the results of our inquiries, and the suggestions founded upon them. Course pursued.

It appeared necessary, in the first instance, previous to any inspection of foreign schools, to make ourselves acquainted with the instruction given at those Establishments for Military Education to which our attention was especially directed. With this view, we immediately visited the Royal Military Academy at Woolwich and the Royal Engineers Establishment at Chatham, at both of which every assistance was given us by the Authorities; and since our return from abroad we have repeated our visit to Woolwich, with a view of comparing some points in the system of education there pursued with the principal features of the teaching in Foreign Schools. English Academies.

Immediately after our inspection of these Establishments, we thought it desirable to examine the French system for training Artillery and Engineer Officers, as followed in the Polytechnic School and in the School of Application at Metz, to both of which our attention was more particularly called by the nature of our Instructions. French Schools.

Having thus had an opportunity of comparing the teaching in these Institutions with that given in our own, our next duty appeared to be to circulate questions soliciting the opinions and suggestions of Officers in the two Special Corps with regard to the manner in which our own system of education has worked, and the expediency of making certain alterations. In adopting this course, it was our wish to obtain extensively the opinions of Officers of different ranks and experience. We therefore selected nearly an equal number in each Corps; regard being had, in the first place, to Officers of high rank; secondly, to those who had directed or had been closely connected with the education at Woolwich and Chatham; thirdly, to Officers on service who had had recent opportunities of testing the merits of the training of the Academies; and lastly, to junior Officers who were comparatively fresh from their instruction. Some of our questions were intentionally of a very general nature, in order to give room for the expression of such variety of opinion on the education of the two Corps as we understood to exist. English Evidence. *Vide* pp. 310–314.

The number of Officers to whom we applied was limited by the employment of a large portion on active service in the Crimea or on foreign stations, and by the full occupation of many others in England. But though this fact may have somewhat diminished the amount of the evidence sent us, full information has been given respecting the Royal Military Academy and the Establishment at Chatham, and we have received many valuable suggestions upon points of general Military Education. Our Report will show the constant assistance we have derived from this evidence; and if it should be thought that we have quoted it too largely, our excuse is that we have felt on many subjects that the judgment of the Officers who gave us their advice was of far more importance, and would deservedly exercise a greater influence, than the statement of our own opinions.

We endeavoured also to obtain the opinions of Foreign Officers on the working of education in their own country. Thus, in the case of the Polytechnic School, having been struck both by its excellent teaching, and by the points Foreign Evidence. pp. 42–52.

Visits to Foreign Schools.

of difference it presented to our own system, we requested the opinions of several Scientific Officers and other persons connected with the School, with regard to the effect of its high scientific studies on the Special Arms in France. The answers, which were most willingly sent to our questions, we have placed in immediate connexion with our account of the instruction given in the Polytechnic itself, and the School of Application at Metz. We also followed a similar course in Prussia, where we were able to obtain a full and valuable account of the history and working of some parts of the Prussian educational system from Colonel Von Holleben, who is now, and has been for many years, Adjutant to the General-Inspector of Military Education.

French.

Prussian.

pp. 127–133.

Inspection of Foreign Schools.

Our principal object, however, has been an examination of the chief Military Schools in France, Austria, Prussia, and (although less minutely) in Sardinia; and an account of the Military teaching and training given at these Institutions will form the second portion of the accompanying Report. We have added, in the case of each country, such a preliminary outline of the General Military System as appeared necessary to make the plan of education intelligible.

Full details given of the Schools.

It may, perhaps, be thought that some of these Schools have been described with an excessive minuteness, and we should certainly have been glad to enter into details more sparingly, and to confine ourselves mainly to the results of our Inquiry. We were persuaded, however, that the proper object of our investigations was rather to lay before competent judges the actual state of Military Education abroad, than to give solely or principally our own impressions with respect to it. And it is doubtful whether, without ample details, the character and value of Foreign Military Education could have been properly estimated, or a just impression conveyed of the care with which it is assisted and directed by the Government of each country. It may be remarked that, while we have endeavoured to give a complete view of each system, the Schools which we have described most minutely are those of the Special Arms, the principal objects of our inquiry. It is hardly necessary to add that we may have fallen inadvertently into occasional errors of detail. But we have used our best endeavours, both by care at the time, and by subsequent correspondence, to avoid this danger; and we trust that any such defect will not prevent our description from being substantially faithful and accurate.

In carrying out these objects, our acknowledgement is due for the assistance we have derived from the very valuable services of Mr. A. H. Clough, of the Educational Department of the Privy Council, who by your Lordship's permission was appointed to act as our Secretary. During the last six months, when Mr. Clough's services were unavoidably withdrawn from us, we have to acknowledge the able assistance of Mr. G. E. Ranken, of the War Office. We have to thank Mr. Sylvester for his valuable translation of the Programmes of the Polytechnic School inserted in the Appendix.

Plan of Report.

As regards the form of our Report, we have thought it best to separate the parts mentioned above, containing a detailed account of Military Education, and the evidence sent to us, from our general statement, which will give the results of our Inquiry and our Recommendations.

In this General Statement, with which we commence, we shall follow the plan which appears best to carry out our instructions.

Schools visited.

i. We shall describe briefly the course we adopted in visiting Foreign Military Schools, taking this opportunity of expressing our acknowledgments to many Officers and other Gentlemen who assisted us in our inquiry, and whose suggestions were often our most valuable guide.

Character of Foreign Military Education.

ii. We shall endeavour to give such an account of the principal features of Military Education in each country as may render the systems followed intelligible; showing the principles upon which Officers of the different Arms are educated, the extent to which that education is carried, and the means by which it is directed and encouraged.

General Military Education in England.

iii. We shall, in the same manner, although more briefly, describe the general Military Education of our own country; and in pursuance of our instructions, "to record all such facts and observations as may appear of importance with "reference to Military Education," we shall consider some of the principles applicable to all Military Education. We limit ourselves to principles, because we are not empowered to draw up a detailed Plan for the Education of Officers of the whole Army, or to make any recommendation with regard to Sandhurst.

iv. We shall give a detailed plan for the education to be pursued in future in the Royal Military Academy at Woolwich, in accordance with the recent regulations of entrance at a later age than formerly, and by a competitive examination. From this basis our instructions directed us to start. Plan proposed for Woolwich.

v. The recommendations offered by Artillery Officers with regard to supplying further opportunities for scientific and practical training, *after leaving the Academy*, will be stated, with suggestions on the subject. Later Artillery and Engineer Course.

vi. The opportunities for instruction now afforded at Chatham to young Engineer Officers will be considered, and some recommendations offered for improving and extending them.

I.—PROCEEDINGS IN VISITING FOREIGN SCHOOLS.

FRANCE.

Paris.

Having received our instructions on the 26th of January, and having visited Woolwich and Chatham, we reached Paris on February 3rd; and by the valuable assistance of Lieut.-Colonel Claremont, C.B., Her Majesty's Military Commissioner at Paris, immediate permission was obtained from the Minister at War to visit the chief Military Schools in France. These are the great School of St. Cyr, near Versailles, for Officers of the Line; the School of Application for the Staff Corps, in Paris; and the Polytechnic, with one of its supplementary Schools of Application at Metz, intended for the training of Officers of the Special Corps. In this preliminary outline of our proceedings, it is only necessary to state, that while each of these Schools has its separate Board of Improvement, all are under the central control of the Minister of War; that they are conducted with the vigorous competition which characterises the whole French system of Military Education; and that the whole teaching is materially influenced by the fact that the pupils of these Institutions are young men rather than boys, since seventeen is the earliest age at which Military Education commences in France. It was soon, indeed, forced upon our attention that a Civil Education of long duration is in France always preliminary to a Military one, and that the Military Schools exercise a powerful influence, by means of their competitive entrance examinations, on the general education of the country. These facts, we shall leave it to the body of our Report to illustrate; but we were led in consequence to study Civil in its connexion with Military Education in France, and we endeavoured to make ourselves acquainted with some of the great Lycées (or Public Schools), which act as feeders to the Polytechnic and to St. Cyr. Of these we inspected particularly that of St. Louis in Paris, which is considered to give a good preparation for the Military Schools; and we have thought it necessary to give some account of the general system of the Lycées. Nature of the Schools, and course pursued in visiting them.

Our chief attention was devoted to the Polytechnic School, which we visited on several occasions, and examined carefully. We shall have occasion more than once to dwell on the system of that remarkable institution, and we will only mention at present that every possible facility for studying its working was afforded to us by the kindness of the Commandant, General Eblé, and of Colonel Riffault, the Inspector of Studies; whilst the information supplied to us most kindly by Professors, Examiners, and former eminent pupils of the school, assisted us to understand its striking system of teaching, and to estimate its effects upon its Military students. We must take this opportunity of expressing our obligations to M. Biot, of the Institute, to M. de Barante, to General Vicomte de la Hitte, to Generals Poncelet, Piobert, and Charron, Lieut.-Colonel Favé, and M. de Polignac, all formerly pupils of the school; and also to M. Duhamel, M. C. Hermite, and M. Bertrand, Members of the Institute, and connected with the Polytechnic as Professors or Examiners. We beg also to thank M. Villemain for allowing us to profit by his knowledge of every kind of education in France. Polytechnic School.

After inspecting the other great schools alluded to, St. Cyr and the Staff School, we visited the School of Musketry at Vincennes, and some of the Civil Schools of Application connected with the Polytechnic. In all these cases the Directors or Professors supplied us with every information and document which we required, many of which we have translated and placed as Appendices in a separate volume. We obtained similar documents in other countries, which will be found generally to contain each school's account of its own working, its system and lectures, drawn up in many instances very minutely, and these may Schools of St. Cyr, and the Staff.

Visits to Foreign Schools.

be made a means either of verifying or correcting our accounts. We should add that in all our visits to the schools in or near Paris, we had the advantage of Lieut.-Colonel Claremont's company and assistance.

School of Application at Metz.

We spent a month in examining the schools we have mentioned, and leaving Paris for Metz at the beginning of March, we found upon our arrival that the examinations of the Sub-lieutenants for entrance to the Artillery and Engineers were going on. Opportunities for witnessing these, and for inspecting the school and other educational establishments, were immediately afforded to us by the kindness of General Mary-Monge, Commandant of the Garrison, of General de Boblaye, the Commandant of the School, Lieut.-Colonel Lafont, the Second in Command, and General Morin, Member of the Institute, the President of the Jury of Examiners then sitting. On the 5th and 6th of March we were conducted over the large buildings forming the School of Application, and on the 7th over the School of Pyrotechny and the Arsenal. On the 8th we were allowed to attend the Examinations of the young Officers in the School, and on the 11th were admitted to the Regimental School of Engineers.

See pp. 310–314.

During our stay at Metz we drew up a series of questions, to which we have already alluded, to be addressed to Artillery and Engineer Officers in England, in accordance with our instructions, directing us to circulate "questions among such persons as are likely to be able to assist us by their knowledge and abilities." We had previously, before leaving Paris, addressed a series of inquiries to scientific Officers and other Gentlemen more or less connected with the Polytechnic School.

PRUSSIA.

Berlin.

After leaving Metz we reached Berlin on the 15th of March, and upon placing ourselves in communication with his Excellency Her Majesty's Minister Lord Bloomfield, were immediately introduced by him to General von Peucker, the Inspector General of Military Education, who furnished us with credentials admitting us to all the principal Military Schools.

Prussian Schools.

We found in Prussia a still closer connexion between the Military and the Civil Education of the country than we had found in France; indeed, the great Military School for young men *before* their entrance into the Army bases its special military teaching on a complete general education. In fact, although the Cadet School has the name, drill, uniform, and all the associations of a Military College, there is nothing professional in its teaching till a pupil enters the highest or selected class at about seventeen. The Military Education is very careful and complete; but it would be only to anticipate our general account, if we were to explain the peculiar system on which the whole training is founded. We shall limit ourselves at present to remarking, that the most important schools

Division Schools.

are frequented *after* entrance into the Army; that the *Division-Schools* are meant to give a nine months professional teaching to every young *Candidate-Officer* before he finally gains his Commission; that nine months of actual service must precede entrance into the School for the Artillery and Engineers;

Staff School.

and that the War School, or School for the Staff, is a very laborious, indeed almost an overtaught, Senior Department. Of these, the Staff School and the

Artillery and Engineers School.

Artillery and Engineers School are both in Berlin; and by the kindness of their respective Commandants we were allowed carefully to inspect them, and were supplied with much information, and with some useful documents relating to both, which will be found among our Appendices. The Division-Schools are nine in number, and are situated in the chief garrison towns in the kingdom. We inspected the nearest of these, the School for the Officers of the Guards at Potsdam. And we also had an opportunity of visiting the Upper Cadet School at Berlin; one of the Junior Houses which prepare pupils for it at Potsdam; together with an establishment for training Non-commissioned Officers, and a large Orphan House for the sons of soldiers, both of which are also at Potsdam.

Officers consulted.

We derived much information from the Officers presiding over these schools, and we also had an opportunity of profiting by the valuable suggestions of General von Willisen, and of Colonel von Holleben, Adjutant of the General Inspector of Military Instruction and Education. This latter Officer gave us a full account of the working of Prussian military education, and he has since had the kindness to send us his opinion in writing on some of the most important points in the system. We invite attention to this valuable evidence.

Vide pp. 127–133.

PRUSSIA.

We received much assistance from Captain Junge, on the Staff of the Artillery and Engineer School; from Lieutenant Berger, of the 28th Prussian Infantry, an Officer studying at the Staff School, and from Mr. Pertz, a young Engineer Cadet; and lastly, Dr. Wiese, a member of the Commission for Admission into the Cadet Corps, gave us an account of the manner in which the common schools of the country prepare young men for their first examination on entering the army.

AUSTRIA.

We left Berlin at the end of March, and proceeded to Vienna. The Austrian War Department is under the direct supervision of H.M. the Emperor, but is divided into four Sections, each having its separate head. His Excellency Sir Hamilton Seymour had already acquainted General Baron Gorizutti, the Chief of the Fourth or Educational Section of the War Office, with the object of our inquiry; and we desire to express the amplest acknowledgments for the courtesy and interest with which General Gorizutti and Colonel Scudier, the Officers at the head of this Section, met or anticipated our wishes for information. Major Dwernecky, of the Staff, and Captain Christl, of the Artillery, accompanied us and assisted our inquiries at all the Educational Institutions we desired to visit; and every document bearing on the teaching of the schools, the expenses, or the promotion connected with education, was placed at our disposal. We have also to thank Colonel Count Nugent for much information on the Austrian army. The Schools we inspected may be arranged in accordance with the main divisions under which the education falls, of schools for Non-commissioned Officers,—preparatory schools for Officers,—and the Senior Departments for the Staff, the Artillery and Engineers, and the Military Teachers.

Vienna.

Department of Military Education.

1. The first of these classes, the schools for *Non-commissioned Officers*, constitute a peculiar and interesting part of the Austrian military education. We visited, before any other, the School Company for the Artillery at Vienna, and were immediately struck by the care bestowed on the education, and the liberality of the domestic arrangements. Two similar schools were inspected at Kloster Neuburg, on the Danube—an Infantry School Company and a Flotilla School Company—the object of the latter being to train effective Non-commissioned Officers, some of whom may afterwards be made Officers, for the Flotilla service on the rivers, lakes, and lagoons of the Empire. We visited afterwards one of the junior institutions for boys from eleven to fifteen years of age, which serve as the feeders for these schools. This was the Upper House of Education at Kuttenberg, in Bohemia.

Schools for Non-commissioned Officers.

School Companies.

2. The second class of Institutions, those for the preparatory education of *Officers*, are specially termed Cadet Houses and Academies. There are four of each class. Of these we visited Hainburg, near Presburg, as a specimen of the junior or cadet institutions; Wiener Neustadt, thirty miles from Vienna, the chief Academy for the preparation of young Officers of Infantry and Cavalry; the Artillery Academy at Olmütz, and the Engineer Academy at Znaim, in Moravia. On visiting Wiener Neustadt on the 8th of April, we were conducted by Colonel Knoll, the Commandant, over the establishment, which, in its buildings and its general arrangements, may be described as the most magnificent we have anywhere seen; and we afterwards inspected a very striking school for the education of military instructors. At both schools we were present at examinations of the scholars.

Schools for Officers.

Wiener Neustadt.

Wiener Neustadt is soon to be made the centre of all the military educational establishments for Officers, by removing to it the Academies for the Artillery and the Engineers, and an United Higher Course for both these Corps. The buildings for these academies are to be upon an immense scale, at an expense which is calculated at 1,000,000*l.* sterling. The plans were shown to us by Colonel Scholl, of the Engineers, who designed them, and is intrusted with the charge of carrying them out. In the meantime two of our number had inspected the Artillery Academy at Olmütz; and on visiting the Engineer Academy at Znaim, we had the advantage of accompanying General Gorizutti, the chief of the educational section of the Ministry of War, who proposed to us that we should join him in his visit of inspection. Every opportunity for studying the school was also afforded us during the two days of our visit by the Commandant General Khautz von Eulenthal.

Artillery Academy at Olmütz, and Engineer Academy at Znaim.

3. The third class of Austrian schools, that of *special* schools and *senior* departments, contains the Staff School, the Higher Course for the Artillery and

3. Senior and Special Schools.

Visits to Foreign Schools.

Engineers, and the Institution for Military Teachers. We visited the Staff School at Vienna on different occasions, were present at its examinations, and spent some time in the rooms with the Officers studying there. Much information was received from the Commandant and the Professors of drawing and military history; and we shall elsewhere invite attention to the interesting character of all the teaching. The United Higher Course of study for the Artillery and Engineers is not yet completed. It is provisionally in operation for the Engineers only, at Znaim, and we have described its commencement and its plans of study. The School for Military Teachers was visited at Wiener Neustadt.

Besides the above schools, we inspected at Vienna the Bureau of the Geographical Engineers and the Polytechnic School.

SARDINIA.

Turin.

Accademia.

School of Ivrea.

Although the extent and variety of the Austrian schools engrossed much of the time allowed for our work, we were anxious to obtain an authentic account of the state of Military Education in the Sardinian States, and one of our number visited Turin for this purpose. He received there every assistance from Sir James Hudson and Colonel Righini, and inspected successively the Accademia Regia Militare (the general school for Officers who enter the Army as such), the Staff School, and the School for the Artillery and Engineers. He also obtained an account of the Officers' School at Ivrea for Officers of Infantry and Cavalry before they obtain the rank of Captain, which was not at that time in operation. These Schools, owing to the late demand for Officers, could not all of them be considered in their normal state,—but we are enabled, both from personal inspection, and from the documents which were supplied to us, to give what we believe to be a correct outline of their system and regulations.

Great assistance was received in this inquiry from the Honourable E. M. Erskine, Secretary of Legation at Turin, whose complete knowledge of the country made his suggestions most valuable, and who has since supplied us with additional information.

II.—GENERAL ACCOUNT OF FOREIGN SYSTEMS.

Section I.—France.

Principles of the different Systems.

Having detailed the opportunities thus liberally offered for studying Foreign Military Education, we shall proceed to describe the nature of the different systems, referring for fuller information to the details given in the report of the schools of each separate country. The principles of this education are distinct in each case, and are strongly marked by differences of national character. In France, highly rewarded competition is the mainspring of the whole system; in Prussia the chief object aimed at appears to be the attainment of a good average of general and professional education from all Officers whatever; in Austria vigorous competition is the principle of the Staff School, with high education for a small portion of the Officers, and a most liberal encouragement of Non-commissioned Officers; finally, in Sardinia there is, again, considerable competition. Everywhere there is an organization for education so systematic, and so large an expenditure for the purpose, as to show both the value attached in a military point of view to the teaching and training of Officers and the position it occupies in the general education of the country. Such is the mere outline. Following it into its details, we commence with France.

French education.

The feature which principally attracts attention in French Military Education is the remarkable character of the Polytechnic School and the teaching it gives to the Officers of the Special Corps. But this great School, the principal Scientific Institution in existence connected with any Army, may more properly be reserved, together with its School of Application, as the highest points of French Military Education; and we shall previously state the marked principles on which the whole of this education is based, and which are carried out in all the other Military Schools of the country.

Its characteristics. p. 3.

pp. 12, 14, 53, 54.

The characteristic points of the French system are as follows: (1,) the proportion, founded apparently upon principle, which Officers educated in Military Schools are made to bear to those promoted for service from the ranks; (2,) the mature age at which military education begins; (3,) the system of thorough competition on which it is founded, and (4,) the extensive State assistance afforded

to successful candidates for entrance into Military Schools, whenever their circumstances require it.

Officers from the Military Schools. p. 3.

1. In the French army one-third of the Officers in the Line, two-thirds of those in the Scientific Corps, and the whole of the Staff, receive a careful Professional Education; the remainder are appointed from the ranks, by the choice of the Emperor, on the recommendation of their superior Officers. We were assured, however, that the latter class of Officers do not usually rise above the rank of Captain; and the inference would seem to be that for the inferior commands, courage and conduct are considered sufficient qualifications, while scientific study and professional knowledge are thought requisite for the higher.

No Juvenile Education.

2. The next point worthy of notice is the manner in which France has gradually but completely thrown aside the idea of juvenile military education, adopting in its place the plan of giving professional teaching and training to young men, just as they are emerging into manhood, and when their general education may be almost considered to be completed. In this practice France in some respects differs from any other country, although Prussia resembles her in giving no specific Military Education at a very early age. The experiment of thus making a good general education the basis of a special military one seems to have first been tried on the foundation of the Polytechnic School in 1793, and the idea is in great measure due to the practical genius of Fourcroy and Carnot. On the very first establishment of this school young men were allowed to enter it at the average age of eighteen, with the prospect of joining the Army after two or three years; and it was soon found that they brought to their special studies a freshness and energy far greater than boys who had been taught, and perhaps sated with, military subjects from the age of twelve or thirteen. Gradually the system adopted at the Polytechnic was extended to the other Army schools, and although the Lycées under the First Empire were coloured with what may be called military fashions,—which, indeed, to some extent affect all French education,—Juvenile Military Schools were in the course of time discontinued or diminished; and after 1814 the principle of juvenile military education may be said to have been entirely abandoned. The plan adopted instead says, in effect: "Give your young men a sound education, in the best schools of the "country, till the age of seventeen or eighteen; at that age, let them compete "for entrance into a Military College, where they will be instructed for two, "three, or four years, according to the requirements of the service they are to "enter; once entered into the school, the State will assist them in their educa-"tion, and will thus enable them to commence a career."

Example set by the Polytechnic.

Principle now adopted.

3. With this alteration in respect of age was combined the establishment of the principle of competition for admission into Military Schools; and the extent to which this practice is encouraged will be amply illustrated by the account of every Military School.

pp. 12, 53, 54.

4. Every candidate who can succeed in the open and competitive Entrance Examination to St. Cyr and the Polytechnic School is entitled, according to his means, to a partial or entire support from the State. At the present time, not less than one-third of the students in each of these schools receive such maintenance. It is, however, manifest that such a regulation, combined with other points in the social system of France, while it developes talent, must exercise a democratic influence on the Army.

Such are the principles adopted by France in encouraging the education of that portion of its Officers from whom alone it requires educational qualifications: and these principles are carried out at St. Cyr, for the Line; at the Staff School, for which St. Cyr is the principal feeder; and at the Polytechnic, and its School of Application at Metz.

Schools. 1. St Cyr. p. 14.

The preliminary studies which best fit a pupil for the competitive entrance examination to St. Cyr are almost entirely mathematical. This is one of the points in which the peculiar genius of France colours its Military Education somewhat differently from that of other countries. We shall remark elsewhere, in speaking of the Polytechnic, though quite recognizing the superiority of mathematics over any other single element in Military Teaching, that to encourage this to an almost exclusive extent (as is done in France) militates against the

Account of Foreign Systems.

principle of a complete *liberal* education; and in England a liberal education is justly considered of greater consequence than a special intellectual training in any single subject however important. The above remark applies, however, as regards St. Cyr, solely to its entrance examination, and the preliminary studies it encourages. The instruction given at the school itself seems to us well considered and judicious. The young men enter, on an average, between the ages of seventeen and eighteen; they spend two years at the school; and on leaving, twenty-two of the best scholars usually obtain places in the Staff School, and the rest choose their Regiments according to their places on the examination list.

Instruction at St. Cyr.
p. 58.
pp. 53, 54.

The nature of the studies may be judged of from the following Table:—

First year's lectures,—	Second year's lectures,—
27 in descriptive geometry.	10 in topography.
35 in physical science.	27 in fortification.
20 in military literature.	15 in artillery.
35 in military history.	10 in military legislation.
27 in geography and military statistics.	12 in military administration.
30 in German.	27 in military art and history.
	20 in German.
Total, 174	Total, 121

Character of the Teaching.

It will be observed that Military Literature, Military History, Military Geography and Statistics, constitute nearly half the total number of lectures in each year; and, indeed, in every good Military School on the Continent, we have found these subjects insisted upon, as the best means of interesting a young Officer in the study of his Profession. The other subjects taught are also essential parts of the instruction of an educated Officer; and it must be remembered that these *lectures* (which for the whole year may appear few in number) occupy much more time than English *lessons;* notes upon them being always written out, and the whole work gone over with the *répétiteur*, an assistant to the Professor, whose office is very fully described in the account of the Polytechnic School. We must add that practical exercises form a great part of the military training given at St. Cyr, greater, for instance, than in the chief Austrian Academy at Wiener Neustadt, the school to which it bears the closest resemblance. There is apparently more study at Wiener Neustadt, and an equal prospect of ultimate appointments is held out to its pupils.

p. 19.

Competition.

Competition is encouraged in the whole school course, by the effect which the credits given at the numerous examinations have upon the student's position in the Final Examination, when the total result of his efforts may gain for him the coveted prize of admission to the School for the Staff Corps. It should be remembered that the social position of a large proportion of pupils both at St. Cyr and the Polytechnic is such as to make the prizes given at each, objects of much greater ambition than would probably be the case in England.

2. Staff School.
p. 65.

Entrance into the School of Application for the Staff Corps may be considered the reward of proficiency at St. Cyr, the twenty-two best pupils of which, together with three from the Polytechnic, constitute the ordinary yearly admission to this school. Strictly speaking, indeed, the twenty-seven best pupils from St. Cyr compete for the entrance to the Staff School with an equal number of Sub-Lieutenants, who may obtain permission from their commanding Officer to appear as candidates. But we were informed that few, if any, now present themselves. The course of teaching lasts for two years, no less than eighteen Professors being employed, and the principal studies being Topography, Military Art, and Fortification. The pupils are carefully ranged in the order of merit at their different examinations, and enter the Staff Corps according to the places they finally obtain. Immediately on leaving the School, they are made Lieutenants, and are then sent to the Infantry to do duty for two years, and at the expiration of this time are attached for an equal period to the Cavalry. They *may* finally be sent, but are not necessarily so, for a year to the Artillery or Engineers.

p. 69.
p. 71.
p. 66.

Competitive spirit of French Military Education.

It is obvious that both these Schools carry out the main principle of French Military Education—open competition, upon which it more thoroughly relies

than any other country we have visited. This principle, as well as that of the later commencement of Military Education, was apparently first brought to influence the army on the establishment of the Polytechnic School. In the continuous wars which ensued, promotion and reward must indeed have been given upon other considerations than those of success in military studies, but during the long period of comparative peace it seems to have been established that the best ground for advancement, at least in the earliest stage of an Officer's course, was proof of talent and attainments in the profession which he had selected.

3. Polytechnic School. pp. 6–30.

It will not excite surprise that this spirit should be found most active at its very birthplace, in the most competitive School in the world, the Polytechnic itself. From first to last every detail of the teaching given there is devised for this end. The general results, it cannot be doubted, have been remarkably successful; and though they have not been solely military (for the school is partly a civil one), they have placed the Special Arms in France in a higher relative position, in point of mathematical instruction, than is probably the case in any other continental army.

Peculiarities of the School.

The plan of this school is so peculiar, and so unlike that of any other in England or elsewhere, that we must refer those who wish to understand its influence on the scientific training of the Special Arms to the fuller account given in our Report. Some details, however, must accompany our remarks; and, indeed, the principles of the school are both instructive educationally, and are calculated (even where not directly applicable to our own state) to throw light on interesting questions of Military Education. The whole system brings out in its strongest light the French practice with regard to competition, and the French estimate of the value of high scientific attainments in a military point of view.

A preparatory school for the Public Services. p. 11.

The Polytechnic is a great preparatory school, possessing a monopoly of admission into twelve of the chief public services of France, among which are those of the Artillery and Engineers, many of the others being of a civil character. There is a public, and always a very severe competition for admission; every detail of the education is skilfully devised to encourage emulation during the pupil's course; and there is a final competition for a choice amongst the 140 or 150 appointments which the school yearly offers.

Its advantages.

In mentioning these facts, we have probably said enough to show the advantages of such a school, both in the amount of ability it can collect, and in the stimulus it supplies to exertion. The talent encouraged is almost solely mathematical, that peculiar talent of France, which is of all others the best fitted for the preparatory teaching of the Special Corps of the Army. And thus it would appear, at first sight, *that in point of theoretical instruction*, the Officers of the French Artillery and Engineers must excel those of all other European Armies; and it is certainly our opinion that this is the case. But having praised this school so highly, both here and in our detailed account of it, we are entitled with equal frankness to state some drawbacks which may, perhaps, detract from the efficiency of its military pupils. We invite attention to the evidence of French Officers upon this point.

Vide p. 42–52.

Drawbacks. p. 25.

1. All the highest prizes are civil ones, and this is certainly a drawback, even if compensated for by other advantages. It was not so much felt in the days of the First Empire, when all the talent of France streamed into the Army. But since that time it has usually been found that, with a few striking exceptions (chiefly of distinguished pupils of the higher ranks), the thirty or forty first pupils choose the Civil Services.

2. The system of education, excellent as it is in its stimulating power, has one or two marked defects. Such is the attempt to give exactly the same teaching, lesson by lesson, during a course of two years, to a class of 160 pupils, with no reference to their varieties of ability or powers of application. This practice has a tendency either to make many of the pupils superficial, or to exhaust them. Now it must be remembered that the majority of these pupils enter the Army; and hence, probably, the numerous complaints on both points, from the Military Authorities at Metz, who possess the best opportunity of testing the effects of the Polytechnic. Another defect is that already referred to, the exclusively mathematical spirit encouraged, which may be said entirely to overshoot its

Account of Foreign Systems.

mark, and to prevent (what seems to us most desirable for a scientific soldier) the education from being truly liberal. Nor can we avoid remarking that education has its moral as well as its merely intellectual side; and we were not nearly so much impressed by the moral and manly as by the intellectual effects of the Polytechnic teaching. It is the more necessary to state this, because in describing the system pursued at the school, we have naturally been led to dwell chiefly on its intellectual results.

Advantages.

In spite of these drawbacks the Polytechnic School appeared to us a most instructive study for purposes of Military Education. Many points in its system of teaching are admirable, and above everything else it seemed to evidence the extraordinary spirit imparted to education by the competition created by its valuable prizes. It does in this respect, for the Army and the Services of the Public Works in France, what the Universities do chiefly for the Bar and the Clerical Profession in England. It gives every possible encouragement to early application and talent, while by the pecuniary aid of the State it places this talent in a position to do itself justice.

4. School of Application at Metz. pp. 31–40.

The School of Application at Metz is the completion of the Polytechnic scientific training for most of its military pupils. They are Sub-Lieutenants on admission, and they pursue during two years a course which is partly practical, but in which theory still holds a prominent place, and is carried to a greater extent than we conceive to be necessary or desirable for *all* Officers,—even for those of the Special Arms. A brief summary would give but an inadequate idea of these studies, and we must, therefore, refer for complete information to the description of the School of Metz, given in the second portion of our Report, and to the translation of its principal programmes in the Appendix. The studies of Artillery and Engineer Officers are conducted entirely in common for the first and for two-thirds of the second year; but during the remaining third they diverge widely. Yet even at Metz the instruction of Officers for the Special Arms is not held to be completed. They join their Regiments upon leaving, and are employed in practical exercises with troops till they obtain the rank of Second Captain in their respective Arms; then the training of Artillery Officers, apart from their men, is, in a certain sense, resumed; they are sent to the Arsenals, Foundries, and Manufactories of Arms.

App., pp. 88–136.

pp. 34, 35.

p. 40.

Section II.—Prussia.

Distinct principle of Prussian Education.

The Prussian system of Military Education, while it is most carefully and systematically planned, and resembles in some important points that of France, is mainly, however, founded upon a distinct principle. There is less both of the competition so much relied upon in France, and of the prizes which encourage it. The practice, and what may be called the spirit on which the practice rests, are both different. The apparent object of the Prussian plan, and its practical working, is to secure a good average of education both general and professional, not from a proportion of select Officers, but *universally* from all Officers of the Service. In other respects, in the care with which Military Education is superintended, and in pecuniary Foundations to assist pupils, France and Prussia are not dissimilar; the marked point of separation is that the one is thoroughly competitive, while the other, though not absolutely rejecting competition, uses its stimulus very sparingly.

The double examination of all candidates for commissions.

The means by which it is attempted in Prussia to attain this universal educational standard, are the exaction of a double qualification from every candidate or *aspirant* for a Commission, before that Commission is actually granted. The Candidate enters the Army in the ranks, though frequently with a promise of a nomination to a Commission from the Colonel of a Regiment. The first qualification required is to pass an examination testing his general and liberal education, which must be undergone at some time within six months after joining. This examination (called the *Portépée-fähnrich*), is not however, required from about fifty of the Candidates, who have previously given proofs of higher proficiency in the first class public schools, and the two highest classes of the Cadet School pass it before entering the army. During these six months the *Aspirant* gains some practical knowledge of ordinary military duties by serving in the ranks; but such service, we were informed, is enforced with very

pp. 87, 90, 104.

different degrees of strictness by the Colonels of different Regiments. The first six months ended, he usually goes for nine months more to the Division Schools, (though this is not obligatory,) to obtain the professional knowledge which is to qualify for the Second, *or Officer's* examination. These Schools are an Institution peculiar to Prussia. They have undergone several changes; and the education given was at first *general* as well as *professional*, but it is now strictly *professional*. They were also at first very numerous, almost to the extent of one for every Regiment; but they have been gradually diminished to nine, and are now about to be reduced to three. Their course of teaching we have elsewhere given in detail. They are considered so important an Institution in Prussia, that we must call attention to Colonel von Holleben's account of them, and his sketch of their progress. When this course is completed the Aspirant may be examined for his Commission, for which a second, but no further trial is allowed. If successful he is then eligible for the next vacancy; but even at this point his progress towards obtaining a Commission may be stopped by an adverse vote of the Officers of the Corps, who have thus the power of black-balling a candidate whom, in the words of the official books, they may consider unworthy of becoming their comrade (*nicht würdig in seine Mitte zu treten*). This is the mode of obtaining Commissions in the Infantry and Cavalry; one precisely similar in principle, with some slight differences in details, is adopted for the Special Corps.

Division Schools. p. 106.

Vide p. 129.

pp. 93, 94.

We have given in this description what may be called the leading idea of the Prussian system, the requirement of a fair education from all the Officers of the Army. This requirement seems to be honestly carried out, and with increasing success; for as the Army has raised the standard of its Entrance Examination, the schools have improved their preparation for it. At the same time, the studies in the Division Schools appear to give a fair professional teaching.

Evidence of Colonel von Holleben, p. 119.

Meanwhile it would be incorrect to state that no distinctions are offered for military study. There is much competition in the Select Class of the Cadet House at Berlin, half the scholars of which are distinguished by having no examinations after entering the Army. "The young men who obtain testimonials "of fitness for the University and the Select Class of the Cadet House must be "considered," says Colonel von Holleben, "in point of scientific preparation, "an excellent supply of Officers." But the main object of the system is that *every* candidate should show "professional knowledge and education." The still more important principle of "opportunities for the few of higher talent" seemed less completely carried out.

Colonel von Holleben's Evidence, p. 132.

Other points deserve notice as more or less connected with the practice of Prussia. It is evidently considered desirable to limit Commissions in the Army almost exclusively to the upper ranks and the sons of Officers: we were told that all Colonels in promising nominations kept this object in view, and the check exercised by the Officers points the same way. We were also assured that the advancement of Non-commissioned Officers in time of peace to the rank of Officers was an extremely rare occurrence.

Other points noticed.

Again, one leading point of view in which the Cadet Schools were regarded seemed to consist in the means of keeping up a military *esprit de corps*. The necessity for this appears to be the more felt, because from the Prussian Army resembling a militia, a strong *esprit de corps* is needed in the Officers to counterbalance the shifting and civil character of the rest of the troops. Thus a Military School is regarded as a nursery for military sentiment as well as a means of forming and encouraging military science.

Some account of the chief Schools will complete our view of Military Education in Prussia.

The Educational Course may be said to begin with the Cadet Schools, four of which, the Junior Establishments situated in provincial towns, lead to one finishing Cadet House in Berlin, containing 420 boys. In the course of the last five years about one hundred Cadets have annually entered the Army; but in consequence of the increase of numbers in the Cadet Houses, it is expected that as many as one hundred and fifty will in future join the Army every year. In spite of their name, these Schools are intended to give a Civil as much as a Military Education; but they offer a very large number of free places to the sons of Officers; their uniform and traditions encourage a military spirit; and the pupils of the highest class (called the *selecta*) receive

Outline of the different schools. Cadet Houses. pp. 99–105.

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a professional education, and are allowed to pass the two usual examinations for entering the Army whilst still belonging to the school. This class, from whence about sixty young men enter the Army yearly, supplies the only preliminary Military Education in Prussia.

Division Schools. pp. 106–108. pp. 129–133.

The next point in Military Education is the Division School, in which, after six months of service, the candidate usually receives his professional teaching. These schools we have described fully in our Report of Prussia.

Artillery and Engineer School. pp. 109–111. pp. 134–153.

The Artillery and Engineer School does for the Artillery and Engineers what the Division School does for the Line. Its teaching, to which we have already alluded, may be best estimated from the translations we have given of official documents relating to the school and the programmes of its lectures. The education given to the Artillery and Engineers in this school is identical in the first year, and differs only as regards the character of the drawing in the second. In the third, however, it has greater differences, viz. in Drawing, Fortification, Artillery, Military Engineering, and Construction, and the Veterinary Art.

Staff School. pp. 112–117.

The Staff School is made in Prussia the principal entrance to the Staff Corps, and as the admission to this School is competitive in France, Prussia, Austria, and Sardinia, it may be considered in those countries the natural prize for a distinguished young Officer, inasmuch as it secures him a place on the Staff Corps. It does not, however, completely fulfil this last condition in Prussia. The principle of open competition is indeed asserted in the entrance examination, where about half the candidates obtain places in the school; but at the final examination on leaving the school no classified list is promulgated, and it is not certain that they enter the Staff according to their actual acquirements. This was spoken of as a practical defect. Without entering into the question whether it be desirable to make an Officer's talents his sole claim to a Staff appointment, it appears to us that wherever it is professed, as in France, Prussia, Austria, and Sardinia, that the only road to the Staff is through successful study in the Staff School, it is most consistent with this demand for exertion that the Officers should be placed in the exact order of merit, as in France and Austria, and that this place should fix the order of promotion to the Staff.

The Staff School, open to Officers of all arms, is the final point in Prussian military education; but two subjects remain to be mentioned, the mode in which the cost of education is defrayed, and its Control and Management.

Prussian expenditure on military education. p. 89.

The annual expenditure of Prussia upon Military Education amounts to about 40,000*l.*; nearly all the expenses of the Schools are defrayed by the State; none of them are entirely self-supporting. This may be called a large sum, considering the general careful economy of the Prussian finances, the moderate size of the standing Army, and the very small cost of education in Prussia. A considerable portion of this is devoted to the free, or partially free places in the Cadet Houses, of which there are no less than 720. These are, in fact, exhibitions given by the State for the support of students at a Military School; they are like the vast system of Military Foundations which we shall find in Austria, and may be compared and partly contrasted with the Bourses of the French schools. The *resemblance* consists in the fact that the State contributes about 15,000*l.* yearly to the education of pupils in the Cadet Houses; the *contrast* lies in this aid being given in Prussia to the sons of Officers or State servants, whereas in France it is the reward of successful competitors in need of such assistance.

Direction of military education by the General Inspector. p. 88.

"The whole Department of Military Education and Examination is under the "control of the General Inspector of Military Education, who reports directly "to the King on all matters relating to Instruction, but confers with the Minister "of War on matters of finance. The General Inspector is assisted by a Supreme "Board of Military Studies, acting with him as a Council, consisting of Field "Officers of the Staff and the Special Arms, Consultative Assessors of the "Minister of Worship, and Professors chosen for the purpose."

Besides the above-mentioned Board, which has the supreme direction of Military Education, there is another to conduct the examinations. From this second Board different bodies are deputed, some for the preliminary examination (the Portépée-fähnrich), others for those of the Division Schools. These Examiners are generally distinct from the schools, though in some instances professors from

the schools have a place among them. They are partly military men, partly civilians. PRUSSIA.

Section III.—Austria. AUSTRIA.

The magnitude of the Military Education of Austria entitles it to rank among the chief Institutions of the Empire. It has been remodelled since the wars of 1848, 1849. It is now centralised, and wholly directed by one of the four Co-ordinate Sections of the War Office, which is independent of the others, and reports directly to the Emperor. This Educational or "Fourth" Section has the control of between 300,000*l.* and 400,000*l.* yearly. It provides for the free, or nearly free, Education of more than 5,000 pupils. The extent and completeness of the system will be best understood by a reference to the clear and valuable official account of the schools.

Extent and centralisation of the education. p 160.

Vide pp. 199–220.

The military schools are divided by this document into (1) those which educate pupils for *Non-commissioned Officers*, (2) those which educate for *Officers*, (3) and those *Senior Schools* which complete the education and extend the instruction of both classes. The method of training Non-commissioned Officers is a peculiar and remarkable part of the system; and this and the training of Officers are conducted so much upon the same principle that we shall find an account of the Non-commissioned Officers' schools the best introduction to our more special subject.

Division of the military schools.

1. No less than 5,730 pupils are in process of being educated for Non-commissioned Officers. They are received into a Military School at seven years old, and at that early age are devoted to the Army, with a kind of solemnity, by their fathers, somewhat similar to the practice at Woolwich Academy:—"I "hereby pledge myself to surrender up my son to the Imperial Military Service, "in case of his being admitted into a Military Educational Institution, and "I will under no pretext require his return."* This promise, as the official document states, may no doubt be recalled if the youth finds that he has mistaken his vocation; but it must exercise great influence (and such is its avowed object) in retaining him in it.

1. Non-commissioned Officers.

Pledge given.

* *Vide* translation of Official Account, p. 201.

After passing successively through two Junior Institutions,—the Lower Houses of Education, where he continues till eleven years old, and the Upper Houses, where he remains till fifteen,—the boy receives his finishing course in one of what are termed the School Companies, the highest class of schools for training boys to become Non-commissioned Officers in all arms of the service. These are twenty in number, and scattered over the whole Empire, containing generally 120 pupils each, though in one case only sixty; and with a course of either two or three years, according to the nature of the service. The extent and the requirements of the Empire give a striking variety to their character. Thus, in the frontier School Companies, "the range of the studies is more ex-"tensive, because the Non-commissioned Officers on the Military Frontiers are "entrusted with the general administration, and require of necessity a knowledge "of Political Administration, of Jurisprudence, and Agriculture;"† and thus also the Non-commissioned Officers for the responsible Flotilla Service of the mouths of the great rivers, the lagoons of the Po, the head of the Adriatic, and the lakes, are carefully educated and frequently promoted. Following the course of a pupil through these Upper Houses and School Companies, we were much struck by the sensible and vigorous character of the education, and the motives supplied for exertion.‡ In the Upper Houses the boys compete for entrance to the School Companies which they prefer, and the more scientific companies are a special object of ambition, because it is more usual in these for young men to be raised by their talents to the Academies, and thus made Officers, "free of all cost:" according to the regulations, however, this is possible in all. It may be stated that from six to ten pupils from each of the more scientific School Companies,—the Artillery, Engineer, Pioneer, Flotilla, and Marine Companies,—are yearly transferred to the Academies, to complete their education there for the Officer's Commission.

Two junior schools. p. 161.

Senior or School Companies. p. 162.

Varied character of the education.

† Official account, p. 208.

‡ *See* particularly the account of the Artillery School Company at Vienna, p. 186.

Opportunities of promotion.

Official account, pp. 208, 209.

A system of this kind, supplying at once a good education and large opportunities of advancement, must necessarily operate as a great encouragement to young men educating for Non-commissioned Officers; and allowing for the social

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differences of the two countries, it resembles in spirit the French system, which throws open the gates of the Polytechnic and St. Cyr, and with them a proportion of the Commissions in the Army, to all.

Extensive system of State, provincial, and private foundations for Army Education. pp. 219, 220.

This, however, is not all. The sums devoted to the education of Non-commissioned Officers, as well as Officers, are immense, and may be regarded as a spontaneous contribution of the National Feeling, no less than a State provision. A system both of public and private foundations (*Stiftungen*) prevails—part derived from the Emperor, part from the provinces, part from private gifts and legacies—by which 3,190 pupils are supported in the Houses of Education and the School Companies, and 1,320 in the Cadet Schools and Academies. The very large majority of these exhibitions supply a *complete*, about 200 a *partial*, maintenance. And it is curious to observe the aid to education which is so common in our own Universities, devoted in Austria to what may be termed the great National Institution—the Army,—and retaining all the limitations to the descendants of Founders or Natives of provinces which marked our own foundations. Some of these exhibitions have been founded by foreign soldiers for their own countrymen. Thus there are two bearing the name of the O'Gara and the O'Brady, to be held by any Irishmen of good family, one of which is in the gift of the Roman Catholic Archbishop of Dublin. We should add that this system is still a living and popular one. Within three years the city of Brünn has founded such an exhibition "for sons of Austrian subjects in Moravia, and "by preference in Brünn, in commemoration of His Majesty's escape from "assassination in 1853." We ourselves heard a distinguished Officer express an intention of founding one of these Exhibitions. The comparison with the open *Bourses* of the Polytechnic is remarkable; but the Austrian appointments to free places seem to be given, like the Prussian, solely as rewards for the service of the parent.

2. Education of boys for officers. pp. 184, 210.

2. The education of young men for Officers is conducted upon the same principles which regulate that for Non-commissioned Officers. The age of admission to a Cadet School is about eleven. The pupils are pledged to the service with the same formalities which we have noticed in the Lower Houses of Education. Between fifteen and sixteen they enter one of the Academies for the Line, the Artillery, the Engineers, or the Marine, and after four years they pass to their respective services.

Education very juvenile, but the character of the studies general. pp. 166, 212.

Thus, unlike the French system, that which is followed in Austria commits the pupil to the Army, and to a Military Education, from an early age, resembling herein the plan of the *Accademia Militare* of Turin. But an attempt seems to be made to combine general with special teaching. Thus, although even in the two first years (from fifteen to seventeen), at Wiener Neustadt, there is some introduction of successful practical military teaching, the chief weight is thrown upon mathematics, history, geography, drawing, and French; special military teaching has a greater, though far from an exclusive place, in the two last years. The studies are high, and (as far as we could judge) pursued carefully, and with excellent discipline.

Active competition in the Austrian schools.

The description we have given of the system pursued in the Schools for Non-commissioned Officers will have shown that there is a constant appeal to emulation. The same is found at Wiener Neustadt. There is a careful system of assigning credits during the whole school period, which itself argues competition. The chief immediate reward, indeed, is the choice of a regiment on leaving the school; but the prospect of entering the Staff School stands in no distant perspective, and this is filled with so many pupils from Wiener Neustadt, that it must be looked upon as the sure reward of a successful Neustädter. There are other inducements of a different character. The discipline being strict, pupils are constantly removed from Wiener Neustadt and the other Academies to the schools for Non-commissioned Officers, and though sometimes allowed to enter the army as Officers, it must always be as juniors to their contemporaries at Wiener Neustadt. We heard instances of great strictness in this matter.

Course for the special arms. pp. 169–179.

The new course for the Special Arms in Austria is not yet completely in operation. It is at present carried on separately in the Academy of Olmütz for the Artillery and that of Znaim, in Moravia, for the Engineers. There are 200 pupils in each Academy, and the courses of instruction, which are more special or technical than at Wiener Neustadt, last four years, from the age of fifteen

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to nineteen. The yearly examinations, the manner in which the marks of the monthly examinations tell on the final one, and the careful classification of the pupils in the order of merit, reminded us of the system of the Polytechnic more than any other school we have seen. And an inspection of the very high credits obtained by the first thirty pupils will prove the diligence with which the studies are pursued. We should add that several pupils of marked talents come from the scientific School Companies. A further fact bears witness to the vigour of the discipline. We have alluded to the dismissal of unpromising subjects from the Austrian Military Schools. In the course of three years, since the changes of 1850, it appears that nearly 100 pupils were removed from Znaim, as not coming up to the standard required for the Engineers by the new regulations.

Competition.

Vide p. 176.

Strictness and high standard of teaching.

3. The courses of instruction in the three Academies for Infantry and Cavalry, Artillery, and for Engineers, last for the same time, and run (as it were) parallel to each other. Each is, or is to be, completed by a senior department. The United Course for the Artillery and Engineers is not indeeed yet combined in the magnificent buildings begun at Wiener Neustadt; but it is already organized in a provisional state at Znaim for the Engineers, and the plan of instruction drawn up is a solid one. The arrangements for the general Staff School require more remark.

3. Senior departments.

For special arms.

Staff School.

In our report upon Austrian schools we have specially noticed this School as remarkable for its thorough and open competitive character from first to last, and its very sensible plan of study. Admission to it is by competition, open to Officers of all arms: the pupils are not unduly overburdened with work; perhaps, there is even room for one or two more subjects of importance; but what is done seems to be done thoroughly; the Officers are carefully ranked, on leaving the School, according as the abilities they have displayed, may be considered a criterion of their fitness for employment on the General Staff; and *in this order* they enter the Staff Corps. The consequence is that every Officer knows distinctly, from the time that he first competes for admission until his final examination on leaving, that the order in which he will enter the Staff depends entirely on his own exertions and success at the school. It seemed to us that this open competition produced a spirit of confidence and energy in the students, as great, if not greater, than any we met with elsewhere.

pp. 180–183.

Its open competition.

The whole of the above system of education is directed by the Fourth Section of the War Department. We may here refer generally to our introductory account of Austrian schools for a detail of the manner in which the sums devoted to education are expended. With regard to the other functions of the Central Board, in all the schools we found traces of its activity; and the energy and system which prevail in the Military Teaching of Austria appear in great measure to result from its being directed by this single head.

Direction of Education by the *Fourth Section.*

p. 160.

Section IV.—Sardinia.

SARDINIA.

In the following account of the Sardinian system of Military Education we shall not enter into such detail as in the case of France, Prussia, and Austria. The Sardinian plan of education is simpler and less extensive than those of the above countries, and at the time of our visiting Turin the immediate demand for Officers had been so pressing that the number in the schools was much smaller than would usually be the case. Moreover, the system of education had been in many respects remodelled since the war of 1849. The new plans were not yet in complete operation, and many of those which were so, had not been working long enough to afford a fair trial.

Sardinian education.

Considered, however, as a supplement to that of the greater Military Powers, the education given in the Sardinian States is full of interest, both in the points in which it resembles them, and in some which are peculiar to itself. The general principles of the system may be described as resembling the French. Thus one-third of the Officers who obtain Commissions every year are appointed from deserving Non-commissioned Officers. Thus, again, the system of Bourses or Exhibitions prevails to a large extent in the Chief Military School, the Accademia Militare, of Turin; and, finally, the Special Arms, instead of being placed (as in Germany) in a somewhat inferior position to other parts of the Army, are the favourite as well as the most educated corps in the Sardinian

All who enter the Army as Officers, pass through the Accademia Militare.

School of the Special Arms.

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Service. On the other hand, the system prevails of a separate education, from early years, of pupils intended to enter the Army as Officers.

1. As in Prussia, an attempt is made to secure that every young man entering the Army as an Officer should have both a General and a Professional Education. All pass through the *Accademia Militare*, a large Institution, the pupils of which are, for a portion of their school course, educated alike, after which the ablest are selected for the Artillery and Engineers, and are placed in a class apart, where they work for a year at High Mathematics, Chemistry, and Architectural Drawing, as preparatory to the Artillery and Engineer School. Such is the more general Education.

Schools of Ivrea and Pinerol for Officers. pp. 245–251.

2. A main feature, however, in Sardinian Military Education is the manner in which all Officers who enter the Army as such (for one-third are promoted from the ranks) receive instruction preparatory to being promoted to a Captaincy. Two Institutions have been founded for this purpose,—the School of Ivrea for the Infantry, and that of Pinerol for the Cavalry. Regimental Schools for Officers also exist, and in every Brigade or Division, Officers are taught *topography*, under the supervision of the Chief of the Staff of the Division. Care is taken to make this teaching uniform throughout the Army; and it may be regarded as preparatory to that of the Schools at Ivrea and Pinerol, which accord with the principle of the Prussian Division Schools in requiring that every Officer shall have received professional instruction; but as regards other points, and particularly the period for attending them, these Schools are peculiar to the Sardinian Army. In time of peace no Officer, excepting those of the Special Arms, can obtain a Company without having studied for a year in one or the other of these Schools, and having passed an examination on leaving it. The Instruction given is mainly practical, Field Fortification, the Secondary Operations of War, and Topography being the branches of Military Science taught.

Peculiarity of these Schools.

Primary object of the School.

These Institutions appear to have been *primarily* established with a view to the instruction of Officers and Non-commissioned Officers throughout the Army, and in order to prevent Regiments or Corps from following some peculiar system of their own. The same motive seems to have led to the gradual reduction in number of the Prussian Division Schools. *Secondarily*, however, these Schools have been made available for the purpose of organizing and drilling the reserve of the Sardinian Army, a large body of Conscripts assembled for a few weeks in the autumn of each year in a camp about twelve miles from Turin. This object seems to have been attained most successfully.

Secondary object.

Quite recently a class has been added to the school at Ivrea for the exclusive education of Non-commissioned Officers aspiring to a Commission; and for the sake of economy this class is to be common to Infantry and Cavalry.

During the late war, in consequence of the great demand for Officers, this school was closed, and the rule enforcing attendance relaxed, Officers being promoted to the command of Companies who had not passed their examination; but the Minister of War has now reverted to the former practice, and we are given to understand that the rule will henceforth be rigidly adhered to.

We have given an account of the principles on which the Schools of Ivrea and Pinerol have been founded, and on which they work, for the reason above-mentioned, that they are an important and indeed a peculiar feature of the Sardinian system. They carry out, in fact, that requisition of distinct professional teaching in the case of Officers which Prussia insists upon for those who are *about to become* Officers. And this teaching they appear to have combined in a very practical manner with other military exercises; for, as we have mentioned above, the Officers thus taught appear to be partly employed in drilling and organizing the reserve of the Sardinian Army, which is carried on in their immediate neigbourhood.

3. The Scientific Arms (*Armi dotti*) have long been the favourite and distinguished Corps in the Sardinian Army, and we have mentioned in our account of the "War School" of Frederick the Great, that one of its first Professors was D'Antoni, a celebrated teacher from the Artillery School of Alexandria. The instruction of these Corps, given in part at the Royal Military Academy, is completed in the Artillery and Engineer School, the special course of instruction lasting for a year and a half. The programmes of study for the School will show the nature of the teaching, part of which is peculiar to Engineer Officers.

SARDINIA.

4. The Staff School has only existed since 1850. It is conducted, like the other Staff Schools which we have visited, on the competitive principle, the Officers attending it being ranged according to merit in their final examination, the ablest entering the Staff Corps in that order. Officers must have served four years, and must not have exceeded the age of twenty-eight on their entrance into the School. Indeed, according to the regulations, it is *apparently* only open to Subalterns. The system being competitive, many candidates for entrance into the Staff Corps necessarily fail to obtain appointments. This body of Officers, it is assumed, having received a certain degree of scientific training, are qualified to instruct their comrades in what they have learned. It is consequently from this body of Officers that teachers are derived for the topographical classes established in each Regiment or Brigade. The Staff School having been recently founded, and a period of active war having intervened since its institution, cannot be supposed to have completely organized its system of instruction. We have elsewhere mentioned that Topography, the Art of War, and Fortification, are the branches of military study most attended to; but we have reason to believe that its plan of instruction will be extended. It may not be superfluous to mention the high appreciation in Sardinia of the Austrian General Staff, as tending to confirm our own estimate of the excellence of the Austrian Staff School. We have been recently informed, on the best authority, that some of the most distinguished Sardinian Officers, who, from their service in the Crimea and elsewhere, have been able to compare the merits of different Staff Corps, consider the Austrian General Staff "the best in existence."

As regards the System of Examinations, there is a Standing Board consisting of from *five* to *seven* Officers presided over by a Lieut.-General, which superintends all the more important Examinations of the Military Schools, such as those upon leaving the School, &c. The constant Examinations within the School, when the Cadets are being moved from one class to another, are conducted by the Professors.

The expense of Military Education in the Sardinian States amounts to 18,000*l.* annually. The Military Schools are all under the direction of the Minister of War.

The rules of promotion in the Sardinian Army have lately undergone some modifications. According to the present regulations a certain proportion of the appointments below the rank of Major is by selection, monthly reports of all Officers being sent in to a Board of Six, consisting of the Colonel, Lieutenant-Colonel, and Majors of each Regiment. The object of this is to select young Officers of marked merit for Promotion. After the Majority, promotion by Seniority ceases, and every step is then given by Selection.

Remarks upon Foreign Military Education.

Before quitting the subject of Foreign Military Education, a short consideration of some results of this inquiry may deserve attention, and may serve as a link to connect the Education of other Armies with that of our own.

The national character which appears in the Military Education of every country,—the system and management with which it is conducted,—the prizes and appointments which encourage Military students,—the ages at which they begin their professional studies,—the later opportunities, after entering the service, for completing them,—and the value particularly attached to a high training for the Scientific Arms and the Staff,—such are obviously the first points respecting which an English Officer may desire to know the practice of other countries. We should not, indeed, adequately convey our own impressions, which are founded on a careful study of the schools described in this Report, if we did not at once state our belief that in all the countries we have visited a far greater value is attached to the possession of a high scientific training, by at least a considerable portion of the Officers of the Army, than is the case among ourselves. Not only are the schools made of more importance, the teaching of every school higher, the discipline apparently more strict, the number of teachers generally greater, but the whole of education is conducted on a more complete system, the sums expended for the purpose are far larger, and (what is, perhaps, most important of all) the advantages to be derived from an intelligent study of their

General importance attached to Military education.

REMARKS ON FOREIGN MILITARY EDUCATION.

profession are made more certain and more apparent to the pupils, or the Officers, themselves.

Large expenditure.

1. The clearest proof of the importance attached to a careful education of Officers is afforded by the large expenditure for this purpose. This amounts to about 48,000*l.* yearly in France, and to 26,000*l.* yearly in Prussia; whilst in Austria at least 127,000*l.* are annually spent in this manner.

The sums above mentioned sufficiently indicate the scale upon which Foreign nations educate their Officers. We shall elsewhere draw attention to the contrast presented by our own practice.

Systematic arrangement; the Schools being directed by a Special Department.

2. The system and care with which this education is conducted appears to be not less remarkable. Military Education in France, Austria, Prussia, and Sardinia is made the business of a special department, which is thus enabled to survey the whole system at a glance, to know and to compare the working of all the schools, and by a consistent plan of examinations and inspections to exercise that influence over their Directors and Teachers, without which some schools will necessarily fall behind others, and great inequalities in teaching and discipline be the result. Accordingly, in France all Military Education is under the control of an Educational Section of the War Office. Each of the schools, however, has its own Council, entrusted with the business of yearly reporting and with the suggestion of improvements, and thus each (especially the Polytechnic) possesses that independent influence which is necessary to give position to its Directors and Teachers, and to keep up their interest in its success. In Prussia a very similar direction seems to be exercised by the General-Inspector, who is assisted by a Supreme Board of Military Studies, consisting partly of Military Officers and partly of Civilians, which has the general control of the schools. Here, again, each School has its own Council, which consists generally of its own Authorities and Professors, with the addition of one or two members specially appointed for the purpose; and from this body suggestions for improvement emanate, and its recommendations and influence may be usually considered authoritative. In Austria the system is more completely centralised, and whilst the Governors and Professors of the schools, doubtless, exercise great influence, the whole machine of Austrian military education appears to be practically directed by General Gorizutti, the chief of the fourth or educational section of the War Office, assisted by his able Adjutant Colonel Scudier, of the Staff, and by several other Officers of the Staff and Special Arms.

"Bourses," and other means of assisting pupils.

3. Such is the framework of the different systems. When we turn to the particulars of their working, the first object which strikes us is, undoubtedly, the large sum devoted in every country to the *support of Military pupils*, a point distinct from the mere fact of a large expenditure on Education. We have endeavoured to bring out, in our general outline, the strong contrast presented between the principle on which such support is given in France on the one hand, and in Prussia and Austria on the other. In France no qualification is either required or allowed for admission to a Military School, except the ability of the Candidate as shown in the competitive Entrance Examination, and this once secured, every Student is entitled to entire or partial support from the State in proportion to his want of means to support himself. In Austria and Prussia an almost entirely opposite system is adopted. Here the merits of the father towards his country are the measure of the claims of his son, and according to the different proportions or nature of their parents' services (accurately drawn out) the sons of Military Officers and other State servants have the first claim to admission, and to the free or semi-free places in the Military Academies. Such a system is as aristocratical and calculated to maintain what may be termed an exclusive Army spirit as the other is democratic and popular; but both must tend to enlist talent and energy in the service of the Army. In France, free *Bourses* at the Polytechnic School and at St. Cyr are given to nearly one-third of the pupils, and the whole amount of money thus spent may be reckoned at somewhat more than 30,000*l.* a year, in Prussia King's Cadetships cost about 25,000*l.*, and in Austria 47,000*l.* a year are devoted to the *Foundations* for Officers alone, whilst, if we take into account the very careful training of Non-commissioned Officers (the most striking point in the Austrian system), the free or partially free exhibitions will amount to an expenditure of more than 100,000*l.*, yearly. An analogy, which we have already once referred to, forces itself upon our attention again; in countries where the Army is regarded as the most important of all Institutions, it is obviously considered desirable that the same

Different principles on which assistance is given.

assistance should be given towards supplying its picked Officers with a sound Military Education, which in England has been hitherto only devoted at the Universities to the Civil professions.

Remarks on Foreign Military Education.

4. Meanwhile this early assistance is not the only encouragement offered to the pupils of Military Academies. The Staff School, the necessary entrance to the general Staff in every country we have visited, is naturally frequented by a large proportion of the young Officers who have early given proof of ability. In every foreign country the entrance to the Staff School is gained by competition; in all these schools the education is solid and extensive; and everywhere the pupil's entrance into the Staff is gained by his distinctions at the school. This may appear to be carried out less completely in Prussia than elsewhere. But it must be remembered that the object of the Prussian Staff School is as much to give scientific attainments to Officers as to fit them for the Staff Corps. Nor indeed is the Staff School the immediate means of entrance to this Corps, as an Officer must spend three years at the *Bureau de Topographie* after leaving the school. His selection for the Staff thus depends on the Chief of the Staff.

Emulation encouraged by the Staff Schools.

5. With regard to the age at which education usually begins, we cannot conceal our preference for the French and Prussian plan, which makes a sound ordinary education of the country up to sixteen or seventeen the foundation upon which to build *special* military teaching. We shall, probably, recur to this point in speaking of our own system in England; but we must add, that although the early commencement of education in Austria seems open to objections, which would, probably, be less felt in that country than amongst ourselves, yet the sensible and vigorous spirit in which Austrian education is conducted offers many points well worthy of attention. In the case, indeed, of the very large majority of Austrian Officers, few educational requirements are made for a commission, although the amount of practical labour spent in regimental duties is well known to be exceedingly great; but no one who has inspected the Military Academies can doubt of the care with which the Officers, from whom mainly the Staff is to be afterwards formed, are educated. Without the almost impetuous competition which marks the great French schools, both the Austrian schools for the Line and those for the Special Arms, and, above all, the Staff School, call out the energies of their pupils by encouraging a good deal of emulation; the discipline is a matter of rigorous care, and in all the arrangements, even in the healthy position of the schools, manliness equally with steady labour seemed to be the prime objects of concern, reminding us (more than any other Military Institutions) of our English public schools.

Different ages of beginning education.

6. Passing from what appeared to be the best examples of Military Education *before entering the Army*, we must speak of that more purely professional teaching which in some Armies *all* Officers pass through before obtaining Commissions or Promotion. Two Institutions deserve mention in this respect, the Division Schools in Prussia, and the Officers' School at Ivrea in Piedmont,—both of which have for their special object the instruction of Officers of the Line soon after entrance into the service. The system of the Division Schools is fully described in our Report, and we have drawn attention to the arguments which may be urged in its favour, as compared with the proposal to establish Military Instructors in Regiments or Brigades. The Officers' School at Ivrea must (in time of peace) be frequented for a year by every Officer of the Sardinian Army before obtaining a Captaincy. It is impossible to describe its working fully, for it was closed when we visited Turin, owing to the demand for Officers during the late war; but according to its Programmes, Topography, the Secondary Operations of War, and Field Fortification are the principal Studies.

Practical teaching after entering the Army.

7. The Staff School, which in Germany is specially termed the War School (*Krieg-Schule*), is regarded everywhere as the great *Senior Department* for *general* Military Education, excluding by this term that of the Special Arms. Of the position and influence of this School we have spoken sufficiently,—and shall now, therefore, briefly speak of Education given by the foreign Military Powers to Officers of the Special Arms.

8. The education for the Special Arms is begun and ended in France and Prussia at a later age than amongst ourselves. The studies are pursued in each country till about the age of twenty-two, and the extreme care bestowed upon them in France combines with other causes to place the Special Arms in a far higher relative position in the French than in the Prussian or Austrian services, though this position is hardly higher than they occupy in our own and in the

Teaching and training for the Special Arms.

Remarks on Foreign Military Education.

Sardinian Army. In Austria the Special Studies are finished earlier, at nineteen; but a Senior Department has already begun to work. We have remarked that this Senior Department for the Special Arms in Austria is the only existing Institution of the kind, though one of a similar nature has been voluntarily established among our own Artillery Officers. Very great opportunities are, however, offered in France to Officers of the Artillery, after their promotion to the rank of Second Captain, for gaining professional knowledge in Arsenals and Manufactories of Arms.

United instruction.

9. It may be important to remark, that, except in Austria, the studies for Artillery and Engineers are everywhere carried on for a considerable period in common. In France, during the last century, they were for a time separated, but they are now, during the preliminary teaching of the Polytechnic, entirely the same, and afterwards at Metz nearly so, except in the last year, when a division takes place. They are mainly carried on in common in Prussia; and this is also the practice at Turin. In Austria the studies for the Artillery and Engineers are distinct from each other, one Academy being at Olmütz, the other at Znaim; but the later teaching of a portion of selected Officers is to be partially combined in the "United Artillery and Engineer Higher Course," which has commenced its working at Znaim, hitherto for the Engineers only, but which the two corps will henceforth pursue at Wiener Neustadt.

For details regarding teaching and discipline, we must refer to the body of our Report, but two points which struck us in every School may be mentioned.

One and the same course required of all.

10. The first is a point of educational practice differing widely from our own. Young men or boys are scarcely ever allowed to spend other than a definite period, neither more nor less, in Military Schools. A time is fixed, during which it is believed that the appointed course can be completed by average diligence, combined with such intelligence as the entrance examination shows the pupil to possess. If he will not employ these qualities fairly, he is not entitled to gain the advantages of the school by an indulgence beyond that of his fellow students. This principle, we are convinced, is most sound; and at the Polytechnic, at St. Cyr, at the Prussian Artillery and Engineer School, at Wiener Neustadt, at Znaim, and Olmütz, we found it thoroughly acted up to. The want of such a rule is assigned by one of the witnesses to the Sandhurst Committee as a source of great evil, both moral and intellectual, in that College; and the same is believed to have been its effect at Woolwich. It may be worth while adding, that in the Austrian military education, which may, perhaps, be termed the most aristocratic which came before us, we found the discipline the most strict as regards the constant dismissal of unpromising pupils.

Strictness in this point.

Lectures on military history.

11. Great attention is paid in every important school abroad to the lectures on Military Art and History, Tactics, Military Geography and Statistics, and what is termed Military Literature. This remark applies to St. Cyr, the French Staff School, the Prussian and Austrian Staff Schools, the Prussian and Austrian schools for the Special Arms. Their studies are much assisted by the good text-books on these important subjects, which exist in great numbers in Germany and France, but are scarcely found at all amongst ourselves. It might be expected that if Military Education was made more important in England, it would tend to create a literature of this kind: but meanwhile the want of it is a great and preliminary obstacle to the extension of such education. Foreign works, or translations of them, can never suit *our* purposes so well as our own productions, not to speak of its being discreditable to us to rely solely or mainly upon them. We venture to suggest that the Government might advantageously set on foot at once some works of this kind, great care being taken to place the preparation of them in the ablest hands.

Want of English works on these subjects.

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* We beg also to call attention to the list of the Military Studies pursued in the Russian Staff School at St. Petersburg. A copy of the regulations of this School was shown us at Vienna and a translation is given in the Appendix, pp. 212–217.

III.—OUTLINES AND PRINCIPLES OF MILITARY EDUCATION IN ENGLAND.

In the preceding sections we have endeavoured to give an outline of the Military Education of some of the principal nations in Europe, describing the characteristic features of their different systems, whilst we have reserved the minute details of their working for the body of our Report. With regard to suggestions for the improvement of Military Education in our own country, two distinct points are brought before us by our instructions. *First*, we shall carry out the direction "to record all such facts and observations as may "appear of importance with reference to Military Education," by pointing out the bearing which either the practice of other Military nations or the ordinary principles of Education have upon the entire subject of Military Education; *secondly*, we shall recommend, separately and in greater detail, certain alterations in the teaching and training of the two Special Corps.

Two distinct subjects to be noticed:

1. Military Education in general.

2. That of the Special Corps.

With regard to the first point, we beg to observe that while we are not empowered to propose a general plan of education for the whole army, the nature of our inquiry, which has brought before us the whole Military Education of several countries, suggests some reference to the requirements of our whole Army, rather than to those of one single part, however distinguished. Indeed, Military Education, to be treated satisfactorily, *must* in some respects be treated as a whole. Such appears to be the opinion of several Officers who have given us the benefit of their suggestions; and whose plans for the improved Education of the Special Corps combine its instruction with that of the rest of the Army. We refer particularly to the expressions of Sir Howard Douglas, General Chesney, and Colonel Larcom, Officers representing different branches of the service. "The view," says General Chesney, "long taken by me of the "lamentable deficiency of Military Education, has caused me to write under "serious disadvantages, such, in fact, as could not have been felt, if the subjects "of inquiry had been less restricted than they are;" and he proceeds to suggest, with the other Officers whom we have mentioned, that the Education of all Officers should commence at a later date, and in its earliest stage be conducted in one Academy, and in common. And Sir Howard Douglas dwells with equal force on another point of common interest to the whole Army, the necessity of all Military Education being brought under a single Head.

Reasons for referring to general Military Education.

p. 323.

p. 315.

It is obvious, indeed, that the chief questions of interest connected with the Education of the Special Corps, belong no less to that of the whole Army. The relation which a sound Military Education should hold to the Civil Education of the country; the place where it should be given, and the chief advantages of a Military College; the age at which it should begin; the distinctions and position which should be the reward of success in a Military Education; the importance of bringing the whole of Military Education under a single Head; such questions as these, applying as they do to all Branches of the Service, deserve in our judgment some preliminary consideration. Before entering upon them, it will be desirable to give an outline of the present state of our Military Education.

1. *State of Military Education in England.*

An education entitling a student to a Commission in the Infantry or Cavalry is given at present at Sandhurst. Pupils are received at that College between the ages of thirteen and fifteen; they enter on the nomination of the Governor; their instruction lasts either for two or four years, according as they are proficient in study or not; and at the end of this period, if found qualified, the receive a Commission without purchase. The usual number of Cadets appears to be one hundred and eighty, for whom there are sixteen Professors. Such is the course followed at the Junior Department of the College, which we give only

Sandhurst Junior Department.

Military Education in England.

in its most general outlines, and on which we offer no criticism beyond saying that we disapprove of the early age of entrance, and consider that the regulation which allows different pupils to remain for a different time at the College is injurious both to studies and discipline.

Senior Department.

There is also a Senior Department at Sandhurst; of which it appears that the original object, or, to use the words of Sir Howard Douglas, the "special, "distinct, and separate form" was to be, "an establishment for training Officers "for the General Staff." This Institution does not seem, at least recently, to have been regarded as a Staff School in the sense in which Schools bearing the same name in France, Prussia, Austria, and Sardinia, educate for the Staff Corps; since in these countries it is necessary that all Officers on the General Staff should have frequented for some years the Staff School, whilst it appears that out of 216 Officers who have received certificates at the Senior Department of Sandhurst since 1836, only 15 were employed on the Staff in May 1854. Nor can it be doubted that both the importance and the education of the Senior Department, whatever may be the cause, have greatly diminished of late years; since latterly there has been only an attendance of nine or ten Officers; whilst the whole instruction has been in the hands of two, indeed, it may almost be said of one Professor. The significance of this last fact may be estimated when we mention that for the Staff School in France there are thirteen Military and five Civil Professors.

See Sir H. Douglas' Evidence, p. 156.

Sir H. Douglas' Evidence, p. 158.

Evidence, p. 163.

Woolwich Academy. pp. 281–300.

The education for the Artillery and Engineer Service given at Woolwich was conducted until recently upon principles similar to those of the Junior Department at Sandhurst. A boy was nominated to a Cadetship by the Master-General of the Ordnance, and was admitted to the Academy between fourteen and sixteen, on passing an entrance examination. He spent there a period varying from two to four years, according to his proficiency in obtaining theoretical instruction, and was then placed, for a year before receiving his commission, in a practical class at Woolwich. This system has recently been materially changed. Admission into the Academy, since August 1855, has been only attainable by success in an open competitive examination, the minimum age of candidates being seventeen.

Immediately prior to the war, the Cadets appointed to Second Lieutenancies in the Artillery and Engineers respectively, joined the Corps as young Officers at Woolwich and Chatham, and went through the following courses.

Artillery instruction on joining at Woolwich. p. 320.

The young Artillery Officers were employed for a period of about six months under a Director of Artillery studies, whose duty it was to superintend and assist them in professional studies and pursuits; these comprised a course of reading and examination in Military History and Law, Artillery, Fortification, Tactics, the modern languages under proper masters, and the usual company duties, parades, Artillery practice, &c.

Engineer instruction at Chatham. p. 377.

The young Engineer Officers were placed under instruction at the Royal Engineer Establishment for field instruction at Chatham, for a period of about fifteen months. They went through a somewhat limited course of practical Military Engineering, including Sapping, Mining, and Pontooning, a very limited course of Architecture, and an extensive and practical application of the knowledge of Surveying which they had previously acquired at the Royal Military Academy. We shall advert more fully to the nature of the instruction for the Officers of both Corps hereafter.

In the case of Sandhurst and Woolwich, the sons of Officers of different rank obtain their education at rates of payment much lower than the sons of civilians; thus,—

Cost of education.

I. At Sandhurst,—

	£
1. The sons of Officers dying in the service, and leaving their families in pecuniary need, pay	40
2. The sons of Captains, Commanders in the Navy, &c.	50
3. The sons of Colonels, Captains of the Navy, &c.	70
4. The sons of General Officers	80
5. The sons of private gentlemen and noblemen	125

II. At Woolwich,—

	£
1. Sons of Officers of the Army and Navy who have died in the service, and whose families are left in pecuniary distress	20
2. Sons of all Officers of the Navy and Army, under the following ranks	40
3. Sons of Captains and Commanders of the Navy, and of Colonels and Regimental Field Officers of the Army	60
4. Sons of Generals without regiments	70
5. The sons of Admirals and Generals having regiments	80
6. The sons of private gentlemen and noblemen	125

Principle of educating the sons of Officers at lower cost.

The principle of assisting the sons of Officers who have served the country appears a most sound one. It would, however, in our opinion, be far otherwise, if the Parent's service were made a ground *of admittance* into the Academy, instead of the assistance being limited to those who have already obtained entrance by their abilities. If a Military Academy has for its object the encouragement of Military knowledge, it must demand proof of aptitude for this from its pupils, as a title to admission; and if the son of a deserving Officer is dull or indolent, it is a serious injury to the country, to introduce him (on the ground of his father's merits,) into an Academy where his example will injure others; but let him once have won his entrance by his diligence or ability, and then the country may fitly make his father's services a ground of assistance. It may be stated that having made inquiries from the Masters of Public Schools and elsewhere, with regard to the cost of education, we concur entirely with the opinion expressed in the Sandhurst Report, that 100*l.* a year ought to cover the expenses of a pupil at any Military College.

Addiscombe. pp. 263-280.

We may add to this list of English Military Schools the East India Company's Military College at Addiscombe, which we were liberally allowed to inspect, and to which we shall elsewhere draw attention. It is sufficient for our present purpose to state that this College gives a professional education of two years to pupils of all arms in common; that the admittance is by nomination and a *pass* entrance examination, not by competition; and that on leaving the school the pupils are chosen by the authorities of the Company for the different services according to their place in the Final Examination. The general order of choice is (1) for the Engineers; (2) for the Artillery; (3) for the Infantry.

p. 271.

Course by which the chief Military Academies have been made self-supporting.

It should be added that both Sandhurst and Woolwich are practically self-supporting; a fact by no means contemplated on the foundation of either, and which has been the result of a gradual withdrawal of Parliamentary grants, combined with a large accession of what may be termed highly-paying pupils, *i.e.* the sons of civilians. This system, which amounts to making the sons of wealthy civilians contribute towards the education of the other pupils, has been justly spoken of in terms of strong censure by Sir H. Douglas and other witnesses before the Sandhurst Committee. It has been attributed to the temporary jealousy of a Standing Army, and of all Military Education in England; and to the efforts which were constantly made, since the peace of 1815, to induce the Government to curtail expenditure in this direction. The result, as regards Military Education, was to withdraw the subject from public attention, rather than to enlist the public favour by the establishment of a careful and efficient system. And advantage was meanwhile taken of the comparative affluence of the classes from which the Army has been principally officered, to exact the large annual sums mentioned from many of the Cadets. Nothing, indeed, shows more completely how Military Education has been treated in England than the following statement of the sums paid by the State for the education of Officers of different Arms in our own and in other Countries:—

Expenditure upon Military Education.

MILITARY EDUCATION IN ENGLAND.

	France.	Prussia.	Austria.	England.
	£	£	£	£
Infantry and Cavalry -	18,318	18,395*	60,400	Nil. †
Staff- - - - - - -	5,814	3,234	4,300	Nil. †
Department for Military Education and for Examinations	Divided under different heads	1,980	28,000	500‡ 2,230§
Artillery and Engineers - -	24,475	2,540	15,700 12,200	179 R. M. Academy.‖ 1,978 Artillery. 1,793 Engineers.
Totals -	48,607	26,149	127,200	6,650
Deduct Annual Saving on the Royal Military College, Sandhurst -				796†
			£	5,854

Three of the above items, viz. 1,978*l.* for Artillery studies, 2,230*l.* for Examiners for the admissions to Woolwich, and 500*l.* for other examinations, are, either of a very recent, or else of a temporary character; and thus it will appear that the annual sum we have expended till the last few years on the education of all the Officers of our Army has been about 1,300*l.*, not one-twentieth part of the expenditure of Prussia, one-thirty-seventh of that of France, and about the hundredth part of that of Austria. And this is more striking when we compare with this amount the really large sums spent on other Institutions, such as the Military Asylum for boys and teachers, and the Royal Hibernian School; in neither of which is the education properly to be termed Military, and which have no bearing whatever on the Training of Officers, although their own object is most important. In the Army estimates of 1856, we find the following sums:—

	£
Royal Military Asylum for boys and teachers -	18,052
Royal Hibernian Military School - -	9,506
Regimental and Garrison Schools - -	18,565
Total -	46,123

The facts last mentioned oblige us to remark upon the utter impossibility of carrying on Military, or indeed any Education efficiently without such funds as shall supply an adequate body of teachers, and such assistance to distinguished students as may be a stimulus to their efforts. If Military Education is a subject of importance, it is surely worth supporting with the same care with which other great nations direct it; if, on the other hand, it is unimportant, it would be best (as some propose) to throw it aside entirely, and trust only to the education of Public Schools. In England we have hitherto acted upon *neither* plan; we have had an education for our Officers, costing the country little more than 1,300*l.*¶ yearly, and it has been carried on upon no uniform system or principle. We submit that such a course is indefensible upon any theory.

Undoubtedly, some persons may still deny that a Military Education is of any advantage. But we cannot think it desirable to enter upon this question. The greatest military authorities might easily be quoted in favour of the value of a Military Education. And the inquiry we were directed to make is based upon the supposition, that an Officer will be assisted in the practice of his profession by having previously studied its principles.

* Including the expense of the Cadet Houses.

† By the return given at p. 306, there is a balance of 7,967*l.* 4*s.* in favour of the receipts during the ten years between 1846 and 1855, for the Royal Military College at Sandhurst, or 796*l.* annually.

‡ Board of Examination for Commissions in the Army. *See* Army Estimates, 1856-7.

§ Examination of candidates for Commissions in the Artillery and Engineers.

‖ Average of ten years, from 1846 to 1855, inclusive.

¶ We deduct the recent expenditure on the Woolwich examinations.

2. *The Extent and Means of Professional Education.*

All Officers should pass an Examination before gaining a Commission.

The practice of military nations is opposed to the opinion that *all* Officers ought to pass through a Military College, but such an examination is required in almost every country, before obtaining a commission, as may prove the candidate to have received a general or a professional education, or both. We refer chiefly to Sardinia and Prussia. The same principle has been recently adopted among ourselves.

A Military College intended for a small portion only. Its advantages.

With this principle of a General Examination for *all*, must be combined that of a Military College for any young men who may show an early talent for Military Study. It is by no means necessary that the course of training, there given, should be long; two years may be named as the best period of its duration. But it seems almost superfluous to urge, if there is such a thing as an Art of War, that a Military College must be the proper place for studying it; while such institutions seem to possess other advantages of almost equal value, to which we shall presently call attention.

A Staff College for Officers already in the Army.

Lastly, a good Staff College, to be frequented by Officers already in the Army, is necessary to complete the means of Military Education. Such a College, if attendance at it be made a *sine qua non* for a Staff appointment, and still more if Staff appointments are given in accordance with the distinctions of its Pupils, will almost necessarily be frequented by most of the young Officers of talent and energy in the Army.

Existing Institutions sufficient if properly directed.

The mere enumeration of these as the principal means of Military Education will show that no radical alterations are required in our present system. We have the institutions already; and nothing is required to make Military Education most efficient, except to secure that these Colleges should have their proper opportunities of working well. But for this purpose it is essential that the pupils should know distinctly that energy and talent will secure advancement. We shall proceed to suggest means for this object.

ee General Shaw-Kennedy's letter, p. xxxviii.

3. *The Age at which Military Education should begin.*

Objection to commencing Military Education at a very early age.

The earliest age at which Education in Military Schools has hitherto been commenced has been thirteen at Sandhurst and fourteen at Woolwich; and the first question which the account of our present Military Education suggests, is whether it is desirable to begin special military teaching so early. The most obvious disadvantage of such a course is that it withdraws a boy too early from those general and preparatory studies which constitute what is emphatically called a *liberal* education. We believe that this drawback will be found to have considerable weight; especially from the influence and position which the great public schools occupy in England; so that a very early withdrawal from their sphere is felt in after life, both as a social and an intellectual disadvantage. Nor does experience seem to show that the advantages of early professional education are equal to the price at which they are purchased; although it would be undesirable to select an age so late as to render a young Cadet less amenable to strict discipline, and less easily imbued with the feelings of his profession. Some of the chief military countries abroad appear, after having long tried the experiment of early education, to have now adopted a different course. We have already named two years as a sufficient period for Military Instruction.

General feeling on the subject.

We have intimated the chief reasons which would lead us to advocate the commencement of a special Military Education at a later age than that fixed upon at present; and if we do not enter upon this question more fully, it is because we are convinced that the feeling against beginning professional education at a very early age is sufficiently general amongst the members of nearly all professions to make it unnecessary to argue the point at length. In no case is juvenile Military Education recommended in the evidence we have received. Sir John Burgoyne, whilst he "considers the Military Academies by far the best prin- "ciple for the education of young Officers," names "the last two or three "years before obtaining commissions" as the period of their instruction. Sir Howard Douglas, in a plan for the education of the Artillery and Engineers, which he connects with that of other arms of the service, recommends that Officers for the special arms should be previously sent to a general Military

Evidence of Sir J. Burgoyne, p. 347.

p. 315.

AGE AT WHICH MILITARY EDUCATION SHOULD BEGIN.

College; adding, that "one year would probably suffice;" General Chesney speaks of "two or three years." Colonel Larcom thinks that education "might extend "from sixteen to eighteen, on an average;" and Captain Galton considers nineteen to be "the upper limit for entrance," and while justly dwelling upon "youth as an important element in the military training of both mind and "body," he adds, with regard to the minimum age, that "if a limit be thought "desirable, it should be seventeen." "I consider," says Captain Shakespear, R.A., whose experience as commanding the Cadet Company at Woolwich gives increased weight to his testimony, "that much improvement would "be gained towards young men becoming useful and efficient Officers if "the age for admission were sixteen." Colonel Barker, R.A., and Captain Younghusband, R.A., are equally explicit; and we may be allowed to refer to the opinion of General Wetherall before the Sandhurst Committee, who, in recommending not to admit pupils before fifteen, adds—"We always find that "those who are admitted at a later age become better and more useful men."

p. 324.

Col. Larcom's Evidence, p. 353.

p. 366.

p. 412.

Age suggested.

We suggest that the pupils of any Military School should be allowed, before entering it, the full, or nearly the full, benefit of public school or other general education. In recommending this we shall be supported by the example of France, where early professional Education has been superseded by general education till the age of seventeen, completed by about two years of professional study for the general service, and four years for the Special Arms. The Prussian practice, in great measure, is founded on the same principle. The partial agreement of these two countries on this point is the more remarkable because (as we have elsewhere shown) their systems of military education are in many points founded on different principles.

We are therefore of opinion that sixteen should be the earliest limit for entrance to a military college, and nineteen the latest, thus making the average age between seventeen and eighteen. And we are persuaded that young men entering upon new studies at an age when they can understand their bearing on their profession, and having as it were a fresh start if they have hitherto been careless, are likely to pursue them with far more energy and interest than if they had begun them at a very early age, before being alive to their importance.

4. *Whether Military Education could be given in Civil Schools.*

Opinion that Civil Schools are adequate to nearly all the purposes of Military Education.

Having arrived at the conclusion that professional Military Education as hitherto given in this country has been begun at too early an age, we are met by what may be called the extreme opposite view, which would suggest the desirableness of giving up altogether Education in Military Colleges previously to entering the Army, or to entering a purely practical Class or College for the special Corps of Artillery and Engineers. An opinion appears to exist, that the ordinary schools of the country are the best means of giving nearly the whole teaching of general and even military science which is desirable for all classes of Officers before entering the Army. It seems to be thought that not only modern languages and mathematics, but military history and topography are likely to be taught in such schools sufficiently for the highest military purposes—and, that even young men intended for the special arms of the service may, on joining a Military Academy, be absolved, or almost entirely absolved, from any other studies than those included under the expression "a purely practical course." Sir John Burgoyne has alluded to the existence of such a theory, as "a prin-"ciple of obtaining candidates for commissions in the Engineers from private "life, their education to be acquired anywhere. This might have the effect of "leading to (what is indeed advocated as judicious by many) the suppression "of the Military Academies of the service—a system to which I can by no "means assent."

pp. 329–336.
pp. 246–362.

p. 347.

Some slight traces of such an opinion appear in parts of the evidence we have received. Thus Captain Younghusband speaks of "Military History" and "Military Art" as fit subjects of Instruction at Public Schools; and the expression "a more specific Military Education would be given in large schools," might be understood to mean that such Schools can do the work of Military Colleges. We are the more anxious to discuss this opinion fully, because however untenable, it may arise not unnaturally, and derive plausible support, partly from a reaction against the system of juvenile military teaching, and

p. 346.

Causes which may encourage this opinion.

partly from a misapplied admiration for the manly education of our public schools. This feeling might for the moment induce military men and others to look favourably on a plan which seems to us inconsistent with the encouragement of any scientific professional teaching in the Army.

Military Education in Civil Schools.

In the first place, we feel convinced that it is a mistake to suppose that any large proportion of public or important private schools will ever be able to supply completely the special studies necessary before entering "upon a purely practical "course for the Special Corps," or indeed for other Arms of the service. With regard to the preparation at present given by most of the principal Schools of the country, we have before us the evidence of the three recent examinations for entrance at Woolwich, and we are obliged to admit that even on subjects of a very general character, such as Mathematics, Modern Languages, General or English History,—indeed, on almost every subject except Classics,—the ignorance of candidates is so great that attention ought to be given to these fundamental points before there can be any idea of teaching a special and difficult subject, such as that referred to above, Military History. It may, moreover, be doubted whether civil Schools can *ever* give a *complete* preparation to most of their pupils,—such as might be a substitute for the special work of a Military College,—even in studies of a general preparatory character, like Mathematics and Modern Languages. Let us take the case of Mathematics. This study does not form the staple of English education as it does of French; and yet even in France the Public Schools do not profess to complete the pupil's mathematical education before he begins a part of his training in the Polytechnic. In England it cannot be doubted that the average of mathematical attainment is low—and nowhere lower (speaking of the mass of students), nowhere more likely to continue low, than in the Public Schools, however sedulous the efforts made to stimulate the study among pupils destined for the Army: for it must be remembered that in our Public Schools the ascendency of classics is firmly established, and it is exceedingly difficult to obtain attention for studies which are the subordinate and not the favourite subjects of the school instruction. The case will probably be, that in the entrance examinations for Military Colleges, a very few boys will be found well prepared; but that a large proportion will always remain requiring a considerable, though we hope a gradually diminishing, amount of work during a year, if not two years, of scientific teaching.

Civil Schools do not give a complete preparation in points essential to Officers.

Case of mathematics.

A far greater difficulty would be experienced in teaching such a special subject as Military History in public schools. This is spoken of by Sir Howard Douglas, Colonel Portlock, and others, as a most important branch of scientific teaching. It is only necessary to refer to the programmes of Metz, St. Cyr, the French Staff School, or the chief Austrian and Prussian schools, to see what a place it occupies. We refer thus particularly to Military History, because Captain Younghusband has mentioned it; and we might ask any one acquainted with this subject what would be the real value of instruction in it without a considerable knowledge of Topography. To teach so wide and intricate a branch of study effectually in a public school would be impossible. The small number of boys of the same age intended for the Army, and their differences of ability, would contribute to make it so; not to mention the difficulty of obtaining an able teacher where the funds for an object, not of first-rate importance to the school, must be necessarily small. Occasional lectures in Military History, intended to keep alive an interest in the subject, may not be without use; but this is one thing; to attempt to give a complete course of Military Scientific History is a very different one; and we are sure that most Head Masters of Public Schools would never profess what they must know could not be carried out. The case with regard to Modern Languages and Drawing, judging from the experience of the Woolwich Examinations, is still stronger; but we shall have more to say on this point in giving our plan for that Academy.

Military history.

p. 344.

Agreeing, therefore, as to the fact of a "sound general education being given by "public schools," we are unable to draw from it the conclusion that they will "give a specific military education." They may indeed assist our military education, in a manner which the true sense of the terms "sound general "education" expresses,—by encouraging preliminary tastes and studies, such as general history, mathematics, and modern languages, English included, to a greater extent than they do at present. But if there is such a thing as a Science of War at all, it stands to reason that it can only be taught fully in cases

Distinction between the "general sound education" of large Schools and special Military Education.

Military Education in Civil Schools.

where young Officers have the passion and the capacity to begin it early, by its own teachers, and in its own place. The teachers should be practical men, as well as men of military science; the place, a Military College. And the great schools of the country will perform the same service to such an Academy for young scientific Officers as they do for places which give a specific education for other Professions,—they will *prepare for it*, but disclaim any attempt to *complete it*.

Other reasons of weight deserve also to be considered, for it is urged by a large number of Officers that a course of military discipline and training is almost as important as instruction, and that the daily parades and drill of various kinds (not to mention the habits of implicit obedience acquired), will give a practical character to the teaching and imbue the young Cadet with the feelings of an Officer.

Evidence strongly opposed to the above view. pp. 316, 320, 324, 334, 349, 353, 367, 379, 373, 374, 397.

The great body of the evidence we have received certainly leaves no room for doubt with regard to the wishes of Officers of the Special Arms on this subject. We thought it desirable to ask explicitly whether it was considered best that "Officers of the two Corps should proceed at once into a practical class, or be "sent for one or two years into a Military College, for instruction in the "scientific studies, as well as in the modern languages, necessary for the proper "performance of their duties." Except in evidence referred to, there is no single expression which implies the possibility of schools undertaking the specific education now given at Military Colleges. The plan of Sir Howard Douglas, to which we shall draw attention elsewhere, recommends that Officers of the Artillery and Engineers shall be selected from a Military College at Sandhurst, where, he adds, that "probably one year of instruction would suffice." Sir Hew Ross, R.A., is strongly in favour of an Academy, "the education of which "has not failed to produce good fruits; and with such modifications as mature "consideration may suggest, it appears to me," he adds, "difficult to imagine "an establishment more competent to its object." Sir John Burgoyne, whose opinion we shall presently quote fully, is still more explicit as to the advantages in principle of Military Academies.

General Chesney, R.A. p. 324.

General Chesney, R.A., has also discussed the subject in answer to our question:—"This point," he says, "raises the serious question of the comparative "advantages of a military establishment for training and educating Officers, and "the alternative of direct appointments at a later age, for those who may have "been qualified by pursuing their studies elsewhere. It appears to me "that the superiority is almost unquestionably on the side of the Academy, "on account of the lasting advantages which must be the result of an "uniform system of education. The success of the Military Colleges and "other Establishments in France, and elsewhere on the Continent, and in "America, for the instruction of Officers, goes far to decide this question, "and as regards Officers of the Line, we have examples at home."

Colonel Larcom, R.E. p. 353.

The answer of Colonel Larcom to the same question is:—"I think a Military "College necessary between the original entrance examination and the School "of Application. It might extend from sixteen to eighteen on an average, and "at that age or thereabouts, those destined for the Artillery might enter on "their laboratory or other peculiar courses of instruction at Woolwich, and "the Engineers pass to Chatham." Colonel Portlock, late Inspector of Studies at Woolwich, whose knowledge of the results of the late Examinations gives great force to his opinion, says, "our experience up to the present moment "convinces me, that the instruction given in Schools and Colleges is conducted "so loosely, as regards the power of applying knowledge, as to render it "quite insufficient as a basis for practical or professional studies." The opinion of Colonel Barker, R.A., is similar; "pupils should be sent to a Military "College for about two years for the purpose of continuing their scientific "studies." And to show that the judgment of Junior Officers on this point, is not different, we may quote the words of Lieutenant Cowell, R.E.: "After selection is made for the Engineers from the gentlemen who pass at "the public competitive examinations, they should at once proceed to a "Military College, where Fortification, Modern Languages, and some Scientific "Studies should be taught."

Colonel Portlock, R.E. p. 397.

Colonel Barker, R.A. p 334.

Lieutenant Cowell, R.E. p. 374.

But if it were necessary to appeal as a further argument to the practice of other countries, we could fully confirm General Chesney's remark, "that the "success of Military Colleges and other establishments in France and elsewhere

" ....." " goes far to decide this question." In fact, the practice of all Foreign Countries that we have visited, *without exception*, is against the opinion that it is possible to supersede the teaching of Military Academies. Whatever the differences of France, Prussia, Austria, Sardinia, as to Military Education, (and they are often very great,) they all agree in insisting that the Scientific Teaching for young Officers before the commencement of their military career should be given, not in civil schools, but in a special Academy or College of their own, and this thorough preliminary teaching is more particularly required from the Officers of the Special Arms. It might, indeed, be urged that the education given in the general Prussian Military School (the Cadet House) is of a civil character, except in the highest form. It is so designedly,—and because, in accordance with a principle often alluded to, a good civil education is held in Prussia to be the best *preliminary* for a military one. But at the age of seventeen or eighteen the sixty pupils of the first class of the Cadet House receive special military teaching for a year before entering the Army.

Military Education in Civil Schools.

5. *Principle of a Military College.*

In considering the last subject we have endeavoured to indicate the true position of a Military College, standing as it does between the end of a good general education and the beginning of professional service, and being intended to give a special qualification for the latter to such young men as desire a high course of military study. The principle is merely that of every liberal profession, which demands some amount of strictly professional study in its members. In the case of the Army generally, only a short period would be requisite. Such a College should be strict, moderate in expense, and should give real support and reward to energy and talent. The Army is, in many respects, like any other Profession; it contains among its members great distinctions of ability; and it is a clear advantage that such officers as are able to devote themselves to a successful study of their profession should have attention early called to their merits. This is what a good Military Academy effects; it starts the system with the inestimable advantage of laying down the principle that *merit shall be rewarded*, and this principle having been once asserted, it is rendered more difficult to avoid carrying it out in the successive stages of a military career. Indeed, for the purpose of placing young Officers of talent in a marked position, and making professional study respectable in the Army, nothing can stand in the place of a good Military Academy. Such is the theory on which the best foreign Schools work. And we are well contented to rest the further defence of the principle on the statement of Sir John Burgoyne: "I am quite "alive," he says, "to the propriety and advantage of making successive im- "provements in Woolwich, as well as in all other institutions, to meet the "progress of knowledge that time is constantly producing;" but, he adds, "I consider the Military Academies by far the best principle for the education "of young Officers for the last two or three years before obtaining commissions. "There can be no reason why they should not be on the best possible system "for education and moral control; their proceedings can be narrowly watched, "and they possess the very great advantage of inculcating military habits and "knowledge, drill and exercises, &c., imperceptibly as it were, and at a period "when they are easily learned in perfection, and in a manner that leaves a "lasting impression. The principle, I maintain, is good, and therefore, if there "be any defects in the practice, let those defects (which cannot escape notice "and publicity) be amended, and not made the ground for the abandonment of "what is correct in system."

True position of a Military College.

Military Academies best encourage youthful talent.

p. 347.

6. *On the question of Common or Separate Education.*

Supposing boys, after receiving the general education of the country till the age of sixteen or seventeen, to be transferred for a short course of more special instruction to a Military College, the question immediately occurs as to the kind of College desirable. Especially, it may be asked, whether Officers for different branches of the service should receive the earliest part of their Military Education in separate Colleges, as is now the case, or should at first be taught in common, and afterwards be transferred to more special Schools. Each plan has its advantages; in a common College, the competition and the facilities for

The question especially suggested, whether different parts of the army should be educated separately or in common.

COMMON OR SEPARATE EDUCATION.

inspection may both be greater; in separate Academies the different Corps will receive in some respects more appropriate instruction.

We have already stated that our instructions do not warrant us to recommend a plan for the education of the whole Army, for which purpose it would be desirable to obtain the opinion of Officers of the Line; but the question whether Education should be common or separate is of so much importance for the Special Corps that we may be allowed to bring together facts in Foreign Military Teaching tending to throw light upon it. The chief points in the plan we have drawn up for Woolwich Academy, according to our Instructions, would hold good, whether the Education of the Special Arms were given there or elsewhere.

Enumeration of different systems:

In the formation of a general plan of Military Education, it may be well to have before our eyes the different systems pursued elsewhere. We beg to be allowed briefly to recapitulate these under the following heads:—

1. French system.

1. The first plan is that adopted in France. It may be described as Military Education beginning late; extremely competitive, and offering numerous prizes for competition; caring only to educate a fair proportion of its Officers, and with regard to the rest, who rise from the ranks, relying on their practical knowledge and experience. Its duration is two years for the Line, four years for the Special Corps and the Staff.

2. Austrian system.

2. The Austrian plan is, on the first point, opposed to that of France; it begins Military Education very early. The proportion of Officers thus educated is also much smaller, though, perhaps, this fact may be balanced by the careful training given to Non-commissioned Officers. So far as Education extends it greatly encourages competition,—holding out rewards and appointments to pupils distinguishing themselves in the Military Academies.

3. Prussian system.

3. The Prussian system is peculiar, and more elaborate. In the Cadet Houses,—its Military Academies,—which, though open to civilians, are subject to military discipline, and educate the large majority of their pupils for the Army,—Military Education begins late, and so far the French principle seems adopted. Two points in this system seem to deserve great attention. The first is, that a certain, but only a certain, proportion of the Officers receive that higher professional education which is given at the Cadet House. Secondly, the *double examination before gaining a Commission*, is intended to secure both general and Professional knowledge; and the Institution most important for the latter purpose is the Division School, where Military Instruction is given after entering the Army to all future Officers.

With regard to the question of common or separate education, it may be worthy of remark that France, Prussia, and Austria give the whole education of Officers of the Special Corps separate from that of the rest of the Army; in Sardinia it is partly given in common.

4 Plan of common education proposed by—

4. An important plan has latterly been put forward by some distinguished Officers and other persons amongst ourselves, and suggested to us, in parts of the evidence we have received, as likely to be beneficial to the Special Arms no less than to the rest of the service. In this plan it is proposed to make Sandhurst a sort of select College, at which young men intended for all Arms of the Service are to be educated during a certain period in common. At the conclusion of this period, say a year or eighteen months, they are to undergo a competitive examination; and according to the results of this, they may then enter that branch of the service which the position they have gained may entitle them to choose, and the Officers for the Special Corps are then to be drafted off to their different Schools of Application.

Sir Howard Douglas.

Before we take the liberty of remarking upon this scheme, we shall state it in the words of its authors. The first is Sir Howard Douglas, who, after recommending that the Educational Institutions of the Army should be placed under a single Head, continues thus:—

Sandhurst to be a general elementary institution. p. 315.

"Sandhurst might be made a general elementary Institution for youths
" intended to become Officers in all Arms of the Service. Selections might be
" made from these youths for the Line, the Artillery, the Engineers, and the
" General Staff, according to their tastes, their talents, and their qualifications;
" the two last being tested by a good system of examinations."

A more detailed plan, but one founded on the same principle, has been proposed by Major-General Chesney. Considering that the education of the whole Army ought to be embraced in any alterations, he says:—

"Does not the Nation require an establishment somewhat similar to Addis- "combe, in which instruction up to a certain point might be given to the "future Officers of Her Majesty's Army, whether destined for the Cavalry, the "Artillery, the Engineers, or the Infantry?

General Chesney, R.A. p. 323.

"Competitive examinations might take place at a suitable age from a very "enlarged list, say ten times the number of Cadetships. Those so admitted "would have their future Arm decided after a certain time by means of another "Competitive Examination, when those who are to belong to the Artillery and "Engineers would be removed to another Establishment for the practical and "special study of the Scientific Corps.

Instruction up to a certain point to be given to future Officers in common,

"Lastly, a selection by another Examination, not only from the two Scien- "tific Corps, but also from Officers of the Line who are qualified, might "be placed in another Establishment, in order to be prepared for the Staff, as "well as General Commands in the Army.

"Many advantages would be the result of some general system of education, "nor would these be lessened by including the East India Cadets, if space and "other circumstances permitted this to be done."

Colonel Larcom, R.E., expresses the same opinion:—

Colonel Larcom, R.E.

"The true solution of this question is, I think, only to be found in the union "of all Military Education in one College in its early stages, the several Arms "being then drafted off into special schools of application. I see no reason for "combining the education of Engineers with that of the Artillery in particular. "Formerly they were called 'The Scientific Corps,' and there was special "education for them, and for no other part of the Army; but now, that special "education is deemed necessary, to a certain extent, for the whole Army, as "shown for many years past, by the education of a considerable number at "Sandhurst, and more recently, by an entrance examination for all Officers, "the several branches of the army differ in that respect only in degree, and "Staff Duties are on all hands admitted to be Scientific. The staff might, "therefore, with advantage be joined with the Artillery and Engineers in one "College, if the whole Army cannot."

and all Military Education to be united in its earliest stages, p. 353.

It may be added, that a plan substantially the same as the above has been advocated by Mr. Sidney Herbert in Parliament. We give this also fully, that it may be seen in its complete connexion.

similar to that advocated by Mr. Sidney Herbert.

"What I propose is, to reduce the course at Sandhurst to eighteen months "or two years, taking the boys at the age of sixteen, and to make several altera- "tions in the education, the tendency of which would be to make it more prac- "tical and less theoretical; and after the course at Sandhurst, I should propose "that those boys who showed the greatest aptitude for chemistry, mathematics, "and so on, should go to Woolwich to prepare for the Artillery, and that those "who showed the greatest aptitude for architectural science and the like, should "go to Chatham to prepare for the Engineers. I would have, also, a third "school for the Cavalry, where those Officers who are destined for that arm "should learn veterinary surgery, and farriery besides, and all such matters as "are necessary for a Cavalry Officer to know. This school, of course, would "most naturally be placed at Maidstone, which is our great Cavalry depôt. I "would propose that no one should be admitted into the army who had not "passed the examination at Sandhurst, or, at all events, an examination equal "to it. It has been argued that every man who goes into the army should pass "through Sandhurst; but I do not think that would do: it would tie parents "up too much; and I do not think it would be suited to our English habits to "force all through a particular or exclusive educational establishment. I "would require that, from whatever schools the boys came, they should pass "through as strict an examination as is required in the Military Schools. "Besides, as an examination between boys keeps boys up to the mark, so an "examination between schools keeps masters up to the mark, which is equally "important. At the open examinations at Woolwich, which the pressure of the "war rendered necessary not very long ago—first, I think, in the time of the "Duke of Newcastle, and then again of Lord Panmure—it was found, to the "astonishment of the Examiners, that some of the stranger boys were ahead of "the boys at the Academy; and I believe that has not been without its effect "on the Professors at Woolwich. In order to secure perfect impartiality, the "examination should not be conducted by the Sandhurst Professors. You

Common Sandhurst at the age of sixteen, whence pupils are to pass to Chatham, Woolwich, &c.

COMMON OR SEPARATE EDUCATION.

"must have a separate Board of Examiners; and this Board would play a "considerable part in my plan."

It is not necessary to dwell upon the importance of the above plans, which are the most comprehensive for the Education of the Army that have been anywhere brought forward, and for which the names of their authors will secure attention. We think, however, that some points connected with them require to be more fully explained, whilst others are open to question; particularly in their bearing upon the training of Officers for the Special Corps.

Remarks on this plan.

1. Mr. Sidney Herbert has not stated whether he thinks it desirable that the *entrance* to a preparatory College for all Arms should be competitive. If otherwise, it would be a retrograde step as regards the Officers of the Special Corps, who are now selected by open competitive examinations; and we consider this a point of great importance for Officers of whom high science is required, whatever may be the case with the rest of the Army.

2. Again, with regard to the teaching, some difficulty might be experienced in educating together for the first year Officers intended for different Arms of the the service. It may be urged with much force that if in a large school as high a standard of Mathematics is demanded on entrance as is desirable for the Special Corps, it will not be obtained, and that all the after mathematical training will be low in consequence. Thus we found in France that a much higher amount of Mathematics was required for the entrance to the Polytechnic than was thought necessary at St. Cyr, in which school they are not afterwards taught at all; and it is probable that the teaching of the Polytechnic would suffer if its pupils were united in one school with others whose average attainments in scientific knowledge upon entrance was much lower.

p. 14.
p. 48.

3. Another objection of the same kind requires consideration. Mr. Sidney Herbert will certainly not under-estimate the importance of a due amount of ability for those Corps in which, in his own words, "The necessity for scientific "education is the greatest." It must be considered, then, whether (taking into account the much more rapid promotion in other branches of the service) young men of talent will not, in choosing at the end of a year between the different Arms, be led too frequently to decline entrance to the Special Corps, which will involve two or more years of additional close application.

4. Considerable weight must be attached to the fact that the principal Foreign Military Powers have preferred to educate their Officers for the most important branches of the service separately.

We have made the above remarks in no spirit of opposition to this important plan, but simply to intimate that many points deserve to be considered before a decision is arrived at on the subject. But we do not feel entitled to make any recommendation on this subject, and can only bring facts which seem to bear upon it under the notice of the Authorities.

7. *Examination after entering the Army.*

An examination in professional knowledge required from all Officers after entering the service.

We cannot omit to call attention to the practice which exists in some countries of requiring an Examination in Professional subjects from *all* young Officers at some period *after* entrance into the Army. It is found practicable to exact an examination of this kind both in Prussia and Sardinia; and although the time at which it is passed differs in the two Services, the principle in both is the same.

1. In Prussia.
p. 87.

In Prussia a *double examination*, which has already been fully described, is required from all, the Final Examination turning solely on professional knowledge. The preparation is usually made for this examination at a Division School, where a batch of young candidates for Commissions, who have entered the Army but are not yet Officers, about ten or twelve in number, are taught in common for nine months. A practical Military School of this kind, under adequate direction, would have some obvious advantages over the plan of placing Officers as Teachers at the Head Quarters of Divisions.

2. In Sardinia.
pp. 225, 245.

In Sardinia a somewhat different course is followed, the Professional study and subsequent Examination being both placed at a later period. Every Lieutenant is obliged, in time of peace, as a preliminary to obtaining his Captaincy, to attend the Officers' School at Ivrea for a year. We have already dwelt on both plans elsewhere.

8. *Value of Competition in Military Schools.*

Competition in Military Schools.

We have had occasion to notice the strong inducements to exertion held out to the pupils of some of the principal Foreign Military Schools; and we shall now consider to what extent it may be desirable to supply similar motives in our own.

Competition in Military Schools hitherto slight.

The plan of a general school, to which we have just alluded, proposes to introduce competition to a greater extent than exists in our present system. Indeed, it is believed, that at Sandhurst any inducement of this kind has hitherto been slight; and a great want of energy in the efforts of the pupils has been the necessary consequence. At Woolwich, where it has been usual to allow a choice of services to the highest pupils on the list, the motives for exertion have been considerably greater; but the practice of allowing pupils to remain for very different periods at the Academy has greatly interfered with the beneficial working of competition. On the other hand, both in our Civil Education and in the Military Education of other countries, we have everywhere proofs of the importance of encouraging emulation and competition in schools, especially by placing before the pupils those advantages of various kinds of which we shall presently speak, and *without which there is, in fact, little to compete for.*

Differences of opinion on the subject.

But while we recommend a fuller development of competition in schools, and advocate its encouragement by means to which we shall presently draw attention, it may be suggested that the *entrance* to any Military School should be (at least in some degree) competitive. Considerable difference of opinion exists on this point; nor can it be denied that to select Cadets by open examination for the more scientific and smaller Corps of Artillery and Engineers, is a very different matter from throwing open a much larger Military School to Competition. The prize of obtaining a Commission is not, it may be urged, so tempting as it has been represented by many; a proof of which may be found in the fact that in the great mixed Military School, the Polytechnic, the civil prizes are much the most coveted. And in a country where the avenues to wealth and other distinctions make the career of the Army only one amongst the many which young men of energy may select—placing it thus at a certain disadvantage compared with the Armies of the Continent—it may well be doubted whether the press of competition into a general Military School would be active. Such considerations may suggest a doubt whether it would be desirable *entirely* to throw open the admission to Military Schools to Competition. But among the prominent facts of Military Education abroad, particularly in France, is the energy which a system of competition carried out consistently—in the entrance no less than the other examinations,—imparts to the whole teaching of those schools in which it is adopted. A system of mere nomination on the contrary, however conscientiously worked, has always a tendency to lower the standard of the Entrance Examination; for, as Colonel Portlock has forcibly argued, "What "favour would it be to a powerful applicant to give a nomination on the one "hand, and to cancel it on the other by a too stiff examination?"

It may, therefore, be best in this matter to commence with caution, and, *as regards the admission to Military Schools*, to open at first only a limited number of places to public competition. Such a plan is found to answer well in many places of Education, where the presence of young men of superior abilities excites the emulation of others. If such open Competitive Examinations answered they might gradually be extended.

9. *Distinctions and Rewards offered.*

Want of inducement and encouragement to Military study.

Meanwhile a competitive system would probably be unsuccessful in Military Schools, unless it were accompanied by some encouragement much more real, in respect of honours, position, and emolument, than are offered at present, or than seem to have been contemplated by many of the advocates of Army Education. What is there, it may be asked, to induce pupils at a Military School to study Military Science, corresponding in any respect to the inducements which the Universities hold out to the pupils of civil schools? What does a pupil now gain by his study, either immediately or prospectively? And if the surest of all motives to exertion, its effect on their success in life is withdrawn, is it to be expected that the pupils of Military Schools will exert themselves for a prospect of little or nothing? The suc-

Distinctions and Rewards.

cesses of School and College appeal powerfully to a young man's energy and ambition, because they are the forerunners, and usually the support, of a career. Something similar must be offered to the students of a Military College, if it is thought important to draw much early ability into the service of the Army. Otherwise, the very improvement of fixing the entrance to Military Schools at a later age will diminish the number of applicants, for abilities at the age of seventeen are more confirmed, and parents who would be content to allow a boy at thirteen to enter a Military College with moderate, but secured prospects, will hesitate to commit him when his talents have shown themselves, and after a costly education, to a Profession of uncertain success.

Feeling on this subject expressed in the Evidence.

We find in the evidence sent to us many traces of an opinion, which is believed to be prevalent in the Army, that it is useless to speak of giving education, unless it is to be made to tell upon an Officer's advancement. Thus, although none of our questions bore directly on the point, we find Colonel Larcom expressing his conviction that—

Evidence of Colonel Larcom, R.E. p. 351.

"The absence of encouragement has been a greater evil than the want of "facilities. Men will always find the means of attaining knowledge if they feel "that its possession will advance them. Select for superior duties Officers who "distinguish themselves by superior acquirements, and you will soon have high "attainments."

Colonel Portlock, R.E. p. 396.

Colonel Portlock's words are,—"The great stimulus, however, must ever be "the prospect of ultimate success in obtaining the object of labour, and until "it shall be felt that acquisition of knowledge leads to a selection for employ-"ment in honourable and lucrative posts, it cannot be expected that any system "of instruction should be fully successful."

Mr. Sylvester, F.R.S. p. 413.

Mr. Sylvester in the same spirit suggests that—"The beneficial effects of "such a system (of open competition) would be much enhanced by reserving some "substantial advantages to a certain number of such candidates for admission "as should pass the best examination. Two or three of them, for instance, "might be admitted at each entrance on the same terms of subscription as are "now in force in favour of the sons of military men. The spirit of emulation "might also be kept alive by holding out the inducement of analogous advan-"tages, in the shape of increased pay to a limited number of those who pass "the best examinations during their course of study, and on quitting the "Academy."

Two kinds of encouragement suggested.

If Military Education is to be carried on upon the only principles on which any education can succeed,—those of rewarding merit,—we cannot overlook such considerations. The example of foreign nations is here most cogent, and points to two kinds of encouragement:—1. That which is held out to young Officers during their education; 2. That held out to Officers in the prime of life, who are desirous to add a study of their profession to their practical experience. For the *second* of these classes, the Staff School, and the opportunity through it of entering the Staff Corps, seems the appropriate encouragement. But, looking to the particular circumstances of England, to the wealth of other professions, to the opportunities for other kinds of active life, we believe that to place the inducements to enter the Army on a fair footing with those of other professions, means should be taken to mark and reward young men *early* who exhibit industry and talent. This object would be attained by instituting "Queen's Cadetships" for those Cadets who distinguish themselves in the Entrance Examinations to Military Schools; and by an increase of pay to last for some years to those who are most distinguished in the Examination before entering the Service. Other pupils might be allowed the choice of their Regiments and precedence. Some persons may ridicule the idea of rewards of this nature being given to soldiers, just as until lately they would have ridiculed any idea of scientific military study; but we are persuaded that such objections will not bear examination. Rewards of this kind, being also real distinctions, would, undoubtedly, be objects of great competition.

Recommendation of, 1. Queen's Cadetships on entrance to Military Schools;

2. Increase of pay to the most successful pupils on leaving.

Sums to be expended in this manner.

It may then be desirable that at every entrance examination to a Military College, a certain number of the most successful candidates should receive a *partial*, and in some instances, an *entire* support; and on the same principle that the most successful Cadets, on leaving a Military College should receive an increase of pay, to be continued for five years. In both cases, the sums thus expended should be considerable, such as materially to assist a young man at the time when it is often most needed, during the first years of his career. Thus

Military Education is assisted by the *bourses* in France, the *foundations* in Austria, and the *free places* in Prussia; and these rewards would correspond still more nearly to the Scholarships and other kinds of assistance which young men gain at our Universities, and which have been recently extended to the Legal Profession. Supposing eight such "Cadetships" to be assigned yearly to the best pupils *on their entrance* to Military Schools, and a somewhat larger number (say twelve) to be distributed amongst the young Officers intended for different Arms of the Service, and who shall be found most distinguished in military scientific knowledge at the examination *on leaving the College*, the yearly expenditure of the country on such Foundations would amount to 6,000*l.* or 8,000*l.*; and when it is remembered that France devotes for somewhat similar purposes upwards of 30,000*l.* annually, Prussia, 25,000*l.*, and Austria no less a sum than 47,000*l.*, it will be hardly thought, if we have at all stated the exigencies of the case fairly, that the expenditure recommended is an extravagant one. It can scarcely be doubted that this plan would operate as an encouragement to Scientific Military Study, *would bring young Officers of ability into notice from the beginning of their career*, and while thus exercising a favourable influence on the whole tone of the Army, would be found in the end a wise economy on the part of the country. In case such prizes were instituted, it would be desirable not to limit the competition for those before entrance to the Service to the Academies, but to make the Examination open to the pupils of other Institutions. Competition between Schools is as beneficial in its effects as Competition between boys; and it would be an advantage to Military Colleges, as well as to the public, that their pupils should be occasionally beaten in the race by some young man who had received his education elsewhere.

Distinctions and Rewards.

Competition for these distinctions should not be limited to the Military Schools.

If these suggestions meet with approbation, it would be easy to carry out the same principle of rewards and distinction in a School for the Staff.

10. *College or Senior Department for the Staff.*

The points hitherto referred to bear most directly on Military Education before entering the Army, but it impossible to omit all reference to an Institution exercising, in some respects, the strongest influence on Military Science. A College, or Senior Department, for the Staff is indeed the completion, and may be termed the strongest encouragement, of General Military Education, although the Schools of the Special Corps may carry their own Science to a still higher point.

Staff School; the Completion of General Military Education.

The chief defect noticed in connexion with our own Senior Department at Sandhurst has been, that its course of study was regarded as no recommendation for promotion. Nor could *two* Professors be expected adequately to discharge functions for which *eighteen* are required in the French Staff School. The contrast presented by all Foreign Staff Schools is certainly striking. There are differences indeed between these Schools in France and Austria, as to the period of admission and other points. But both are alike in *this*, that they are so framed as to give every conceivable premium and encouragement to such Military acquirements as the Service of the Staff is thought to require. In both the Officers enter by competition, and after a laborious course obtain their appointments on the Staff as the reward of their distinctions in the School. It seems needless to urge that a College of this kind, opening the door to advancement and frequented when the mind is in its full vigour, would possess every inducement to call forth the energies of young Officers of talent. But a Senior Department, offering a bare opportunity for Military Study with no ulterior results, stands in a wholly different position.

Care bestowed on these Institutions in other Countries.

pp. x. xvii. xxi.

It is most important to show the feeling of Officers of Military experience with regard to the absolute necessity of Education for the Staff. We are allowed to quote some passages on this subject from a letter of Lieutenant-General Shaw-Kennedy, C.B., written to a Member of this Commission. His authority will make any comments superfluous:—

"I am not an advocate for very sweeping and radical changes of system. "The Military and all other establishments of a country ought to have "reference to the constitution of the country in which they are formed, and to "the genius and habits of the people. Our Military institutions, according to "my view, do not require any great and radical changes; but there is one "amendment of a very serious character required—the proper Education and "training of Officers, to fit them for filling Staff appointments, and the esta-

College for the Staff.

" blishment of a rule, to be made quite absolute, that no Officer shall be eligible " to fill a Staff appointment until he has gone through a prescribed course " of study and training for the purpose, and obtained the required certificates " of success in that course.

" We have the finest Regiments of Cavalry and Infantry, and the best " Artillery in the world. Those are the noble arms with which England " can meet and overcome anything approaching to an equal numerical force " that may oppose them; but the machine, to act with due effect, must be " properly directed. And by whom must it be directed? Unquestionably by " the Staff. Here we at once come to the immense national importance that " should be attached to the Army's having a carefully educated and well " trained Staff, and the necessity of the rule being absolute that none but " Officers so educated and so trained should be on the Staff."

After giving a detailed plan of instruction for Officers studying for the Staff, General Shaw-Kennedy adds:—

" By shallow thinking persons it may be supposed that this plan for " appointing the Staff of the Army would be opposed by those who may think " that they have interest enough to obtain Staff appointments without such a " course of study and instruction being gone through. But those persons who " possess power and interest must be perfectly aware that that interest will still " tell in their favour, and that the proper mode of meeting the intelligent spirit " of the times is to have their sons, or those under their protection, properly " instructed, so that no objection can possibly be raised to their being appointed " to the Staff of the Army. Even in the event of a General Officer and his " son, would not a very sensible father wish to have the power of saying to his " son that he could only serve with him as Aide-de-camp on his being duly " qualified?" * * * * * *

" It is now necessary that I define what I mean by the term Staff Officer. " By that term I mean Officers of the Quartermaster-General's and Adjutant-" General's Departments, Majors of Brigade, and Aides-de-camp.

" It will be a disputed point whether Majors of Brigade and Aides-de-camp " should be included as Staff Officers who should be required to go through " the course of study and instruction that I have pointed out. But that they " should be so included, I entertain not the smallest doubt. They are liable " to carry orders on the field of battle, which, if not properly understood, may " have the most fatal consequences. Suppose an Aide-de-camp sent with an " order directing a movement at a critical moment, and that he is not suffi-" ciently instructed to understand the order with which he is intrusted, he " must, in this case, merely try to repeat the words in which he received the " order, and if this is not clearly understood when he delivers it, he is, if unac-" quainted with the principles of his profession, totally incapable of explaining " what was really meant. It may very well happen in a Division that the " Officers of the Quartermaster and Adjutant-General's Departments are " absent temporarily from the Division on duty, in which case the Majors of " Brigade should be able to act for them; besides which, Majors of Brigade " should be eligible to be advanced to the Adjutant-General's and Quarter-" master-General's Departments. In addition to these reasons, it is desirable to " extend the number of the instructed Staff of the Army to this extent."

* * * * * *

" It should be borne in mind, that some men are so constituted, that although " they cannot become students and men of science, they may possess some of " the highest qualities of warriors; and that such services are not to be rejected " from mere pedantic considerations. This, however, only brings more strongly " to view a most important fact, not always observed or acknowledged, that " Commanders without science, but having other high qualities, can only " succeed in important operations in the field when assisted by a highly intelli-" gent and carefully instructed Staff. And there is a case deserving the " greatest consideration: all who have ever seen war will admit that the " qualities required by a General Officer commanding in the field are very " rarely met with, and, consequently, it must frequently happen, from the " very nature of man, that important commands fall into the hands of incom-" petent commanders. This it is utterly impossible to avoid, for many men " do not even know themselves before being tried in such commands. The " very great importance of abating or overcoming this most serious evil, is

" that of having a highly instructed and efficient Staff. It may be argued " that a Commander who is defective and obstinate will not be guided by " his Staff. This may apply to ordinary circumstances, but will not always " be the case in actual operations in presence of an enemy; for then the stake " is too great, the responsibility and risk too imminent, for the defective man " not to lean upon those who are able to support him." * *

Military Education in England.

11. *Importance of a Special Board for Military Education.*

We consider it to be of the first importance that Military Education in this country should be regarded as a whole, and that perfect unity of system and harmony in its working should be made to prevail. This, we conceive, can only be done by bringing Military Education generally under the control of one head, the Secretary of State for War; and, to effect this, a Board or Section of Military Education should be formed, as part of the establishment of the War Office.

Importance of establishing a Board of Military Education.

The duties of this Board should consist in drawing up Regulations regarding the Discipline and Instruction to be carried on in all Military and Regimental Schools, Academies, and Colleges; in considering changes that should at any time be made in the Text Books and Studies; in examining representations forwarded from the various Military and Regimental Schools, Academies, and Colleges, or from any persons relating to Military Education, prior to such matters being submitted for the decision of the Secretary of State for War; and in making annual public Reports on the whole department under their charge. One or more members of this Section should attend all the more important Examinations; and all Reports of the results of such Examinations should be forwarded to this Section, to be laid before the Secretary of State.

Superintendence of Military Education to be entrusted to a separate Board.

The creation of such a Section appears to us far more important than any other single object we can recommend. If such a Board were established, a sufficient amount of independence and of pecuniary support being granted to it, all important improvements in Military Education would follow in time almost as a matter of necessity; whilst, without it, they would be in danger of afterwards falling into neglect. We may refer, not only to the energetic influence which such a body appeared to exert in Prussia and Austria, but to the improvements in the general civil education of this country which have resulted from the working of the Committee of Education of the Privy Council. The advantages to be anticipated from adopting a similar plan for the Army have been stated in Parliament by Mr. Sidney Herbert in recommending an Inspector General of Military Education; and our proposal is also in part sanctioned by a suggestion of Sir Howard Douglas in the evidence sent to us.

Importance of this Board, as seen abroad, and in similar institutions at home.

We think that this Section should be under the direction of three Inspectors General of Military Education, one civilian being eligible. We have carefully weighed the advantages of this plan, compared with those of placing a single person at the Head of this Section; but the extent of Military and semi-Military Education, if it were made the business of one Department, the differences in the teaching of the Several Arms, and the value in all Educational Subjects of a variety of knowledge and experience, induce us, in this instance, to prefer the combined action of three to the undivided authority of a single Person. The extent of Military Education, if conducted upon an adequate scale, will require the entire and continuous attention of this Section; and from the connexion of many parts of Military with Civil Education, it is probable that the services of a Civilian conversant with educational matters would be found valuable.

Its constitution.

12. *Summary, &c.*

It has been our object in the preceding pages to draw attention to some leading principles of all Military Education, to assert the importance and the distinct functions of Military Academies, *if properly supported and superintended*, and to suggest such rewards for the study of Military Science as may encourage its pursuit in the Army. For the large majority of Officers, indeed, we believe it sufficient that they shall be proved to have received a sound General Education. But if War has any Science of its own, opportunities of learning that

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Science ought to be offered to those who can use them; and for such our principle is,—a good Civil Education till sixteen or seventeen; then a short Military teaching; lastly, after serving some years, higher opportunities of Education for the Staff. If this principle is true, it can be no Economy to decline carrying it out. To maintain a good Military Education without more Encouragement and more Superintendence than it has hitherto received is indeed impossible; but let it only receive a fair support, and its principles are as safe, its results as necessary to the country, as those of any other Education.

The following are the chief points noticed as important for the objects proposed:—

1. That all Military Education should be directed by a special Section of the War Department or War Office.
2. That Military Education should be commenced at a somewhat later age than at present.
3. That for an efficient Military Education, Military Colleges are indispensable.
4. That the admission into such Colleges should be opened at least partially to Competitive Examinations.
5. That to encourage exertion, "Queen's Cadetships" should be founded for the most successful pupils at the Entrance Examinations.
6. That an increase of pay, to last for five years, should be given to the pupils most distinguished in the Examination, on leaving the College.
7. That all Candidates for Commissions, who have not passed the Examinations at a Military College, should pass a General Examination for admission into the Army.
8. That young Officers after entering the Army should go through some course of Professional Study.
9. That all Examinations should be under the direction of the special Section for Military Education.
10. That encouragement should be given to the later Education of Officers in "Senior Departments."

We shall now proceed to a distinct part of our Report; and shall draw out in greater detail a Scheme for the Instruction and Training of Officers belonging to the Scientific Corps, in accordance with the regulations for admission at a later age than formerly, and by means of a Competitive Examination. We shall only guard ourselves by stating, that we are well aware that many of the details upon which we enter would properly come within the province of such a Section as we have just mentioned; but having been directed to draw up a complete plan, and having for that purpose requested the opinions of several Officers, we feel bound to give a full consideration to the questions which those opinions suggest.

IV.—THE ROYAL MILITARY ACADEMY, WOOLWICH.

The Royal Military Academy, Woolwich.

The Royal Military Academy at Woolwich was established in the year 1741, for instructing "the raw and inexperienced people belonging to the Military "Branch of the Ordnance in the several parts of Mathematics necessary to "qualify them for the service of the Artillery, and the business of Engineers;" and the instruction, it is said, has usually corresponded with that given elsewhere, with the exception of the Classics, which have not been taught since 1777. From its first establishment, it has supplied the greater proportion of the Officers required for the Corps of Royal Engineers, as well as for the Royal Regiment of Artillery.

The Gentlemen Cadets have generally been commanded by the Master-General of the Ordnance, and they have formed a component part of the Royal Regiment of Artillery, from which the Company has been officered. The Institution has always been essentially military, and the Cadets have been placed under Military Discipline and subject to the Articles of War, in proof of which we may observe that many cases of Court-martial have formerly occurred.

Pledge taken by the Cadet not to quit without a discharge.

On joining the Academy, the Cadets sign an acknowledgment pledging themselves not to quit the Institution without a discharge from the Master-General of the Ordnance, a feature curiously resembling that noticed in our account of Austrian military education.

Up to the year 1831, the Parents of Candidates made no annual payments. p. 299.

Up to the year 1831, the maintenance of the establishment was entirely defrayed by the State, the Parents of the Cadets not being called upon to make any annual payment; but subsequent to that time a scale of annual payment has been in force, varied for the sons of persons in the Public Service according to the rank of the parents, and with a maximum rate (125*l.*) for the sons of civilians.

Ages of admission.

The ages of admissions have occasionally varied from 14–16 to 15–17, but the former have been the more general limits with respect to the age for entrance.

Formerly admission was by nomination and a pass examination. p. 287.

Until very recently (1855), all candidates must have obtained a nomination from the Master-General of the Ordnance, and they were not permitted to join the Academy until they had passed the entrance examination, which slightly varied within certain limits according to the age of the candidates.

Subjects of entrance examination. p. 288.

The subjects of examination for admission have not always remained the same, but have been changed from time to time. Those required at the beginning of 1855 were,—English, Mathematics, Latin, French, German, Geography, History, Drawing, and Printing with the Pen.

The entrance examinations were conducted by the Professors and Masters belonging to the Academy, of late years in the presence of the Lieutenant Governor, Inspector, and Assistant Inspector.

Probationary examination at the end of the first year's residence. p. 297.

At the expiration of one year after admission into the Academy, the Cadets were reported upon by a Board of Officers, and such of them as had not passed satisfactory periodical examinations in Mathematics and Fortification in the class-rooms, were examined before this Board by the Professors of Mathematics and Fortification. This examination was called the Probationary Examination. The Board was required to state their opinion whether the progress and conduct of each Cadet brought before them had been such as to entitle them to remain at the institution, or to assign the cause or grounds on which they recommended any Cadet to be removed.

Uncertainty in the duration of the residence. p. 289.

pp. 392, 393.

The Regulations limited the duration of the residence for the course of theoretical study to four years, at the close of which those Cadets who were found unqualified for commissions were required to leave the Academy; but such Cadets as qualified themselves at an earlier period have been permitted to obtain their commissions when they had done so: and thus we find many instances occurring during the same year, where Cadets of twenty and fifty months' residence obtain their commissions at the same time, with no difference in the extent of their qualifications proportioned to the duration of their residence.

Examinations conducted by Professors. p. 296.

Periodical examinations, entirely conducted by the Professors and Masters, take place every six months, usually at the end of each term or half-yearly period, but sometimes more frequently.

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The course of study divided into the Theoretical, and the Practical, course, its nature. pp. 289–295.

The course of study was divided into two perfectly distinct parts, viz.—

I. The Theoretical, limited to four years, and conducted mainly on the tutorial system, embraced Mathematics, Fortification, Descriptive Geometry, History, and Geography, Plan and Landscape Drawing, French, and German.

II. The Practical course of instruction, which has latterly been of one year's duration, not commencing until the Theoretical had entirely finished, included Practical Artillery, Surveying, Field Works, and Lectures on Machinery, Astronomy, Chemistry, Geology, and Mineralogy.

Hours of study.

Seven and a half hours daily were devoted to study in the summer, and seven in the winter, both in the Theoretical and Practical classes.

Vacations and periodical examinations.

There were two vacations annually, each of six weeks' duration, one at Midsummer and the other at Christmas, and the periodical examinations made by the Professors and Masters belonging to the Academy, for the classification in order of merit usually took place immediately before the vacations.

Public examinations. p. 298.

The public examinations of the Cadets proposed to be advanced to the Practical class, or to be promoted from the Practical class to Commissions in the Artillery and Engineers, generally took place at the same time, before a Board of superior Officers. These public examinations did not affect the relative positions in order of merit of the Cadets, which were previously settled by the Examinations made by the Professors and Masters.

Military Staff. p. 286.

The Military Staff of the Academy consisted of—

A Lieutenant-Governor, alternately a General Officer of Artillery or Engineers.
This Officer is now styled Governor, and is a Colonel of Artillery.*

Officers of the Royal Artillery attached to the Cadet Company:—

The 2nd Captain and Paymaster, a 1st Captain in the Artillery.
Ditto for the Practical Class, a 2nd Captain in the Artillery.
Three Lieutenants of the Artillery.
One Quartermaster ditto.

The instruction in military exercises, drills of various kinds, manœuvres, and the discipline out of studies, were under the immediate control of the Second Captain of the Company.

Educational Staff. pp. 286, 287.

The Educational Staff consisted of:—

An Inspector alternately belonging to the Artillery or Engineers, at present belonging to the Artillery,* an Assistant Inspector, a Chaplain, twenty-nine Professors, Instructors, and Masters, of whom nine are military men, in addition to three Lecturers in Chemistry, Geology, and Mineralogy, Mechanics and Metallurgy: thus presenting, independent of the three Lecturers, for a maximum number of about 200 Cadets, an educational staff greater in proportion than that of the Polytechnic School in France, the Cadet Houses in Prussia, the Military Academies in Austria, or the East India Company's Military College at Addiscombe.

Boards of Officers for the superintendence of the entrance, probationary, and final examinations.

Three Boards of Officers were in operation:—

One for the Superintendence of the Examinations of the Candidates for Admission.

Another for the Superintendence of the Probationary Examinations. Both of these Boards consisting of the same individuals, viz., the Lieutenant-Governor, the Inspector, and the Assistant Inspector of Studies.

The third Board for the final examination in the Theoretical course, and also in the course of Practical instruction, consisting of:—

The Director General of Artillery,
The Inspector General of Fortifications,
The Commandant of the Garrison (Woolwich),
The Lieutenant Governor of the Academy,
The Deputy Adjutant General of the Royal Artillery, and
The Commanding Engineer at Woolwich.

The whole responsibility of conducting the Institution rested on the Lieutenant-Governor. p. 298.

The whole responsibility of conducting the establishment rested with the Lieutenant Governor, who had the general charge and superintendence of the institution, and had to see not only that every branch both of Academical and Military Education was conducted according to the rules and regulations, but that the conduct of all and every person belonging to the Establishment, and the general management throughout, were in every respect in strict conformity to them. He was empowered to act summarily with reference to minor acts of misconduct on the part of the Cadets, reporting monthly to the Master General of the Ordnance their names, the nature of their offences, and the punishments he awarded; but for repeated acts of insubordination, of irregularity or immorality of conduct, or for setting a pernicious example, he was required to report each

* These officers have recently received their appointments.

case to the Master-General, with a view to the removal from the Academy of the Cadet so conducting himself, should the Master-General on consideration of the case deem it necessary. WOOLWICH ACADEMY.

General Results.

The above may be termed a short general description of the Royal Military Academy; for further details we must refer to the full account contained in the second portion of our Report. We must state shortly the general results of its establishment on the education of the Officers of Artillery and Engineers at the present time.

We have attentively considered the regulations, dated 1848, drawn up for the guidance of the Lieutenant Governor, Officers, Professors, and Cadets, &c., belonging to the Establishment, and with the exception of some points to which we shall shortly advert, we find nothing in them, or in the information we have received from various quarters, to indicate an absence of that proper control which should exist in a large school of this kind, although there have been, undoubtedly, periods of relaxed discipline, and though great care is required in this respect in every Military School. As far as the very advantageous site of the Academy for affording facilities for giving certain professional instruction, the amount of its Educational Staff, and the arrangements for its government, are concerned, there appeared to us no reason whatever why, with "such alterations and improvements as may meet that progress of knowledge that time is constantly producing," it should not be on an equality with any military school we have seen. In the workshops fitted up with turning-lathes, library, reading room, and racket court, &c., provided for the use of the Cadets during their hours of recreation, they enjoy advantages equal to those met with in any of the great Public Schools in the Kingdom, and superior to those found in any of the Foreign Military Schools. No evidence to indicate a relaxed state of discipline in the Academy. p. 347.

There is, however, apparently, some reason to believe, that the results of the education at the Royal Military Academy have hitherto somewhat failed of that success which might have been hoped for, both as regards Artillery and Engineer Officers.

We do not find among the replies we have received from Artillery Officers any specific mention of deficiencies in the education of the young Officers when they join the Regiment at Woolwich; but it is unquestionable that serious complaints in this respect have been made of late years by some of the Officers of this Corps. Insufficient attainments of the young Officers.

In the case of the Engineers, according to the evidence we have received, the attainments of the majority of young Officers, when they join at Chatham from Woolwich Academy, are not such as might have been expected: either the instruction is not exactly what it should be,—some break in its continuity occurs,—some link is still wanting,—or the mass of the young Officers have not fully mastered the knowledge which has been imparted to them.

Colonel Sandham, the Director, and for many years formerly the Adjutant, of the Royal Engineers' Establishment, states:— Colonel Sandham's opinions on this subject. p. 380.

"The junior Officers on joining at Chatham are always at a loss to apply "their knowledge; the accuracy of their knowledge, therefore, might be "questioned. They are generally deficient in drawing: they should have more "practice and instruction in every description of drawing, figure, landscape, "topographical, and mechanical."

Lieutenant Colonel M'Kerlie, a Member of the Irish Board of Works, and formerly for a considerable time Superintendent of Surveying and Practical Astronomy at Chatham, observes that,— Lieutenant Colonel M'Kerlie's opinion. p. 358.

"Means and opportunities do not ordinarily exist at Chatham on which to "form a judgment as to the extent and depth of the mathematical acquire-"ments of the Officers while under instruction there (the course being almost "entirely of a practical character), but it may be said, that while in each batch "one or two are generally found who possess a comprehensive knowledge of the "subject, who are not found wanting when, as sometimes happens, questions "of difficulty arise and are submitted to them, and who even occasionally extend "and improve that knowledge whilst at Chatham; yet, as regards the greater "number, though their knowledge may be considerable in extent, it is never-"theless but superficial, and as a matter of course is soon forgotten, even "whilst still at Chatham."

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And Captain Scott, the present Superintendent of Surveying, Practical Astronomy, Chemistry, and Civil Works, remarks :—

Captain Scott's opinion. p. 370.

"The generality of Officers have not, in my opinion, on joining at Chatham, "so thorough a knowledge of the subjects they have studied as to be able "readily to apply their information; neither has their theoretical course "extended to the study of Natural Philosophy, some acquaintance with which "I consider absolutely necessary to enable them to follow their course with full "advantage."

Such is a short and general statement of some of the existing deficiencies to which our attention has been specially directed, but before proceeding to investigate the causes which have produced and the remedies that should be adopted to remove them, we must speak of certain questions which have been brought before us, with regard to the Artillery and Engineers, on the answers to which the whole nature and constitution of the Royal Military Academy itself materially depends. Such are :—

I. The possibility of the union of the two Corps of Artillery and Engineers.
II. The advisability, or otherwise, of separating the instruction of the Engineers altogether from that of the Artillery.
III. The expediency of doing away with theoretical instruction, by taking young men direct from the public schools, &c., and sending them immediately to Practical Classes or Schools of Application.

I. *On the Possibility of the Union of the Corps of Artillery and Engineers.*

Practicability or otherwise of uniting the Artillery and Engineers.

Among the first questions brought before us, we have had to consider the idea which has been entertained, although, as we have reason to believe, by a very limited number of persons, that it would be practicable and advantageous to the Public Service if the Artillery and the Engineers were united in one body. It is obvious that such an alteration would solve many of the questions which have been discussed regarding the education of Officers for the two Corps. But, leaving aside for the present the consideration of the replies we have received relating to this subject from various Officers, and the weighty argument against such union, presented by the practice followed in foreign armies; we beg to observe, that although the great proportion of the instruction required is common to the two Arms, the general nature of the two Services is distinct. No doubt they have many points in common, which will account for their joint education, but the Artillery service is as specific as that of the Infantry or Cavalry, and, with the exception of those employed in the manufacture of the *matériel* of the Artillery, the Officers are almost entirely employed in connexion with their men ; the Engineer Service, on the other hand, is very general, and frequently very isolated in its nature; and there is almost as close an affinity and connexion between the Staff duties and the Engineer duties as there is between the Artillery service and the Engineer service. As Major Charters, R.A., distinguishes the Services, "The one Arm is the more active and military, the other the "more scientific and varied in its functions." It is understood, that projects have even been drawn up for subdividing the Corps of Engineers into different branches; a course on which it is not necessary to offer any opinion, but which, it is evident, is entirely at variance with the idea of forming a union between the Artillery and Engineers.

Nature of the two services.

p. 352.

p. 338.

Union of the two corps in France for two years. p. 42–44.

But the union of these two corps into one has already been tested by experience in France, from 1756 to 1758; and judging from the fact that it was only of very short duration, and was not permitted to continue, we must infer that it was not found to answer.

Col. St. George's opinion in favour of the union. p. 328.

It will be noticed that only one reply, that of Colonel St. George, is given in favour of such union, in the following terms :—"If it is meant to ask whether an "absolute amalgamation of the Ordnance Corps is considered desirable, I am of "opinion that it would benefit the service and the individuals. My own ex- "perience convinces me that the selection made when we are boys, for the two "distinct corps, (and which has hitherto been irrevocable,) has no reference "whatever to the adaptation of the individuals to the especial duties of either. "Those cadets who were highest on the list, if they had behaved well, generally "have been allowed to choose their corps. If the two could be merged in "one, all Officers could hereafter be employed in the duties they could best "perform."

On the other hand, the opinion of Officers in general is decidedly opposed to the course thus suggested.

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Major-General Chesney makes the following remarks on this subject:—

Major-General Chesney's opinion.

"It is scarcely necessary to observe, that the Artillery and the Engineer "services are so closely linked, and so inseparately dependent upon one another, "that, in order to be really effective in the most telling operations of war, the "attack and defence of military positions, they cannot be separated for an "instant without the greatest possible disadvantage.

Their duties in the field are closely linked, p. 325.

"We are all aware that the most perfectly executed work, whether per- "manent or merely a temporary defence in the field, would be almost useless "without well-served artillery; and we also know that the power of artillery "would be equally lost were the batteries so placed that the guns could not "be brought to bear upon the enemy at the proper moment. It follows, "therefore, that although, apart from warlike operations, and especially during "peace, there may be objects which require specific and separate attention "from the Engineers as well as the Artillery Officer, the duties of both during "a campaign require the same kind of education; and it seems to me not only "desirable to carry their joint instruction a good deal farther than is at present "done, but also to follow this up by a more enlarged practical course, which "should include the determination of astronomical points, the construction of "permanent and field works, including mines, the erection and armament of "batteries, the study and application of chemistry, the use of the steam-engine, "and telegraphic communications of various kinds, and all that relates to "artillery and military engineering.

and depend upon one another.

Enlargement of the studies desirable.

Mining and other things to be taught.

"A similar education, in every respect, being imparted to the Artillery and "Engineer Officers, the doubt may be expressed, though not without some "hesitation, considering how closely and firmly the two services are linked "together, whether anything would be gained by considering the same Officer "equally fit for each kind of duty. It is probable that, as in the ordinary "avocations of life, more would be gained by eventually giving the undivided "and concentrated energies of an Officer, whose education has been completed, "to his own especial branch, whether that of the Artillery or Engineers. I "should, therefore, advocate their being considered as separate corps, from the "time that the Officers receive their permanent commissions."

Artillery and Engineer Officers to perform separate duties ultimately.

Sir J. Burgoyne says that "a union of the two corps of Artillery and "Engineers would be preposterous, and utter ruin to the service."

Sir J. Burgoyne and Col. Portlock adverse to the Union. pp. 349–397.

Colonel Portlock states, that "In 1757 the British Corps of Engineers was "first formed as a body of Commissioned Officers, having previously existed "as a corps of Warrant Officers only. Before that time the Artillery had "performed some field duties now performed by the Engineers, but it was "then thought expedient to transfer those duties to the latter corps. The "connection, however, between the two services was for a long time very "intimate, for not only were many Artillery Officers transferred to the newly "organized Corps of Engineers, but for many years it appears that the Officers "all joined the Artillery as Second Lieutenants, and were subsequently, after "a sufficient service and training, removed to the Corps of Engineers. Should "the two Corps be united into one, much of the foolish jealousy which now "for the first time exists between them would undoubtedly be extinguished; "but sooner or later it would be found again necessary to separate Officers "performing Engineer duties from those performing Artillery duties, or the "duties of neither the one service nor of the other would be well performed."

Colonel Larcom remarks that the union of the Corps of Artillery and Engineers is "as impossible as the union of Cavalry or Infantry with Engineers."

Colonel Larcom states the Union to be impossible.

Captain Galton observes, that "so far as concerns their education, there can, I "think, be no doubt that the Officers of Artillery should be as thoroughly "acquainted with the principles of fortification as Engineer Officers with the effects "of Artillery. The education of both Corps should, I think, be identical as "regards Military Science, Fortification, and Field works, the principles of "Gunnery, of the equipment of Artillery, and of the Laboratory course.

Captain Galton questions whether it would be possible to make the Officers efficient as Artillerists and Engineers. pp. 352–365.

"Hence the education of both includes a considerable knowledge of mathe- "matics and physical science, of the nature and application of materials, and of "machinery.

"Modern languages are essential to both services.

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" Surveying would also be necessary, at least as far as regards Military Reconnaissance.

" But at this point a divergence of education would take place, the Engineer " proceeding to study the practical details of the Construction of works, and other " Special Branches of his duties; the Artillery Officer, on the other hand, " proceeding to make himself acquainted with the details of his part of the " Profession.

" The detailed knowledge of their respective duties which the Officers of each " Corps must thus acquire is very considerable, and it appears to me to be, to say " the least, very questionable whether it would be possible for the Officers to be " made thoroughly efficient in both capacities."

p. 369.

Captain Scott observes: " I think that the Public Service would be injured by " such a measure. The details of one of the Professions are, I believe, more " numerous than men of fair capacity now make themselves masters of."

On the point which we are now discussing we can have no hesitation in saying that if the question be regarded solely as an educational one, which is the only ground on which we are justified in offering an opinion, the maxim which has been frequently enunciated of learning "little and well" will be best fulfilled by keeping the Corps separate.

II. *On the Advisability or otherwise of separating the Instruction of the Engineers from that of the Artillery.*

Joint education of the Candidates for the Artillery and Engineers.

We have also given special attention to another subject which has been urged on us by some of the Officers who have favoured us with replies to our questions, which was also under the consideration of the Committee appointed to report on the question of Woolwich Academy;—we allude to the education in common of the candidates for the Artillery and Engineers.

Practice in Austria;

In the course of our examination of the foreign military schools, we have found that the separate education of the Artillery and Engineers is provided for in Austria alone, and apparently very efficiently so.

Prussia;

pp. 90, 109, 110.

In Prussia, from the peculiarity of their military system, when the young soldiers enter the Artillery and Engineer School at Berlin they are already young Artillery or Engineer *Officier-aspirants;* yet the instruction for the first year is entirely common; for the second year it only differs as regards the nature of the instruction in drawing; and for the third year it differs as regards the instruction in Artillery, Engineering, and Fortification.

France.

In France the question was distinctly discussed in the " Report of the " Commission appointed to revise the Regulations by which the Constitution of " the School of Artillery and Engineers was drawn up," not, indeed, as regards the propriety of separating the students for the Artillery and Engineers whilst studying the purely theoretical part of their course of instruction at the Polytechnic School, but solely as regards separate instruction at the School of Application.

Report of the French Commission, and Marshal Vaillant's opinion (Appendix, p. 77.)

Marshal Vaillant (the present Minister of War in France), speaking in his own name and in that of the mixed Commission composed of Officers of Artillery and Engineers, says:—

" One leading question affects the whole system of instruction.

" Since the School of Application has been instituted to form Officers of " Artillery and Engineers, is it desirable to separate the instruction given to the " pupils of the two corps and to look solely to the particular requirements of " each?"

" The Commission has not thought this desirable. Allowing, as a general " proposition, that it is well to direct the instruction of young men with a view " to the special service for which they are destined, it has argued wisely that " there are considerations of a higher kind which decide in favour of giving " instruction in common, as far as possible, to the pupils intended for the two " corps."

" I agree in all respects with the view taken by the Commission. The point " of the greatest importance to the success of enterprises undertaken in " common by the Artillery and Engineers is, that there should be a perfect " understanding between two services which always have to support one " another, and sometimes to supply each other's places."

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" The best method of obtaining such an understanding on all occasions, and " of securing that unity of view so necessary to the good of the service, is " undoubtedly to form the Officers of the two services in the same school, and " to give them, as far as may be, the same military instruction and principles."

System followed by the East India Company. p. 259.

In this country the Officers intended for the Honourable East India Company's Artillery and Engineers are drawn from one general Military College, and we have never heard any complaints that the system works otherwise than satisfactorily for the Artillery and Engineers belonging to that Service.

Opinions of Capt. Younghusband, R.A., Col. Barker, R.A., Lieut.-Col. Gardner, R.A., Lieut.-Col. Larcom, R.E. pp. 334, 336, 345, 353.

We should have had no difficulty in assenting to the principle of separate instruction for the Artillery and Engineers, if any proof had been adduced that either service had suffered from the present system. It is true that Captain Younghusband distinctly states that the joint education of the Artillery and Engineers " cannot but be most prejudicial as well to the Artillery as to the public " service;" and Colonel Barker thinks it " extremely probable that separating " the two corps entirely in point of education would be beneficial to the service;" and it may be inferred that such also is Lieutenant-Colonel Gardner's opinion. But these opinions are not apparently sanctioned by those of any of the other Artillery Officers from whom we have received replies, and only receive a modified support, on essentially different grounds, from Lieutenant-Colonel Larcom, who is " satisfied that Engineer instruction can never attain its full and necessary " development while it is exclusively combined with that of the Artillery. " Not the least of the advantages he has always anticipated from the junction " of the Ordnance with the General Army is the severance of the exclusive " connexion of the Engineers with the Artillery, and the more intimate union " with the Scientific Staff of the Army." Still Lieutenant-Colonel Larcom does not recommend separate instruction for the Artillery and Engineers, but united instruction for the whole Army, or if that is deemed impracticable, for the Staff, Artillery, and Engineers, an opinion shared, as already stated, by several Officers who have given us the benefit of their opinions, including Sir H. Douglas.

Opinion in favour of the instruction of the Staff, Artillery, and Engineers being united. pp. 352–315.

Major-General Chesney adverse to the establishment of separate Colleges for the Artillery and Engineers.

Major-General Chesney, R.A., in adverting to this particular question in a paper sent to Colonel Portlock, the President of the Woolwich Academy Committee of 1855, thus expresses himself:—

" Similar but still more powerful objections apply to the proposal for a " separate College for Artillery Officers at Woolwich, and another for Engineer " Officers at Chatham. That some special instruction is required for the Engi- " neer, which is not necessary for the Artillery Officer, is true to a certain " extent. Practical knowledge of the construction of fortresses and barracks, " for instance, is not of much import to the Artillery Officer; and the Engineer " may equally dispense with what relates to casting and boring of guns, as " well as the laboratory duties, and even the extensive use of projectiles.

" But since an acquaintance with the science of fortification is indispensably " necessary for the effective use of garrison and siege artillery, and an intimate " knowledge of the power of these guns is equally required by the sister branch " of the service, it follows as the necessary consequence, that if a separation be " attempted, it will still be requisite that the Officers of each corps shall be sent " for a time to the other, in order to study Artillery in the one case, and Military " Engineering in the other. Since under these circumstances a separation could " be only partially carried out, the establishment of separate Colleges for the " Artillery and Engineers is scarcely desirable."

Major-General Sabine, R.A., thinks the separation of the instruction undesirable.

Major-General Sabine, R.A., observes, " I am very far from thinking the sepa- " ration of the Cadets of the Engineers and of the Artillery into two distinct " Academies, one at Woolwich and the other at Chatham, desirable; on the " contrary, I think the public service would gain by Artillery Officers being " instructed more than they are in the special duties of Engineer Officers, and " *vice versâ*, nor do I limit this to the *Officers* only of the two corps; and " again, from necessity, not from choice, we cannot in our small army carry the " subdivision of employment so far as the French can do. Therefore, I would " propose such educational arrangements for the Officers and Men of the two " corps, and for the Officers in particular, as would bring them more closely " together instead of separating them wider."

Objection to separate Colleges.

The view taken of the matter from a civil point of view is thus expressed by the President of the Geological Society, Mr. W. J. Hamilton; " The same " objection (*i.e.* to the choice of corps being made immediately after the com-

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Unnecessary expense to the Government.

"petitive examination, and as the result of such examination) applies to the "scheme of separate Colleges for the Artillery and Engineers with equal if not "greater force; it is, therefore, unnecessary for me to allude to it any further, "except to point out the unnecessary expense entailed upon the Government, "in keeping up two establishments for teaching the same or nearly the same "subjects."

Candidates for the Artillery and Engineers should be educated together.

Captain Galton says on this subject,—

"After having been selected by Examination, the candidates for the Artillery "and Engineers should be educated together at a Military College. . . . . .

Nature of their instruction.

"In the Military College the candidates should be required to apply their "mathematical knowledge to questions of mechanical and physical science. "They should be taught the theory of the art of war and fortification, "including every branch of attack and defence; plan drawing, descriptive "geometry, the elements of architecture, the principles of chemistry, geology, "and mineralogy, and experimental knowledge of the different qualities of "materials, and the modes of their application.

"They should learn geodesy and surveying in all its branches, military "reconnaissance, and practical astronomy. They should pass through a course "of artillery somewhat similar to that now taught in the Practical class.

Probable duration for these studies.

"It is not probable that the period required for this instruction could be less "than two years. During this time they should be taught the drill of the "Infantry, Cavalry, and Artillery soldiers, fencing, and other exercises.

"At leaving the College, they should be subjected to an examination to "determine the position they are to occupy in the Corps for which they are "destined."

Conclusion against separate establishments for the instruction of the Artillery and Engineers.

In the absence of any proof of injurious effects produced by a joint education, we do not feel ourselves justified in proposing the establishment of a separate Institution, almost precisely analogous to that recommended for the Artillery by Captain Younghusband, R.A., p. 346, for the small number of candidates for the Corps of Engineers, not probably amounting to more than fifteen annually. This consideration would, indeed, in our opinion, be alone sufficient to determine the question, for it is obvious that in so small a body the advantages of emulation would be wanting, and the Staff of Instructors and means of teaching would both be probably diminished. Had the number of candidates for the Engineers amounted to about fifty annually, as in Austria, the circumstances would have been materially changed, and we should then have felt that there might be some advantage in recommending the establishment of an Institution for the Education and Training of Engineer Officers, if any difficulty had occurred in combining their Education with other branches of the Army.

p. 338.

p. 172.

III.—*On the Expediency of doing away with Theoretical Instruction, &c.*

On the propriety of dispensing with theoretical instruction.

One of the principal questions which has engaged our attention with regard to the Royal Military Academy, has had reference to the possibility of dispensing with theoretical teaching of any kind on the part of the Government. We have already entered upon this subject to some extent with reference to the Army in general; but some strong considerations may be urged, particularly applying to the service of the Special Arms. It has been thought by some, that it will be quite possible to obtain, from among the Candidates that present themselves from the Universities, Public and Private Schools, and from private instruction, the number required to supply the wants of these two Services, properly qualified in Mathematics, Fortification, and Drawing; that in such case the selected candidates would then proceed at once to a School of Application.

p. 347.

Nature of a School of Application.

It appears that some very singular and mistaken notions exist as to the nature of the studies usually pursued in a School of Application. It occupies an intermediate position between the Theoretical and that Practical School which is generally supplied by the work of a Profession. Purely theoretical knowledge is not usually obtained at a School of Application, although it must be remembered that the great School at Metz has introduced an amount of theoretical teaching which in our judgment is excessive; but its peculiar functions are, by means of Professors and Instructors, to teach Students to apply the theoretical knowledge they have already acquired, either at a Military Academy

Theoretical Instruction.

or College, Public or Private School, to the correct preparation or developement of projects of various kinds; such as docks, harbours, fortifications, projectiles, buildings, &c., so as to fulfil certain conditions, which are previously laid down.

At the age at which we think it desirable that young men should be selected for the Artillery and Engineers, viz., from sixteen to nineteen, at which latter age they usually go to the Universities, they have scarcely commenced to read the higher mathematics, landscape drawing is but little attended to, fortification is scarcely thought of, and geometrical and military drawing not at all. Hence it would be necessary that mathematics, drawing, and fortification should be among the subjects of study to be followed in any School of Application that it might be proposed to establish; and such a School of Application would be merely another name for a Military Academy.

At the first examination that took place for Woolwich Academy, under the competitive system, in August 1855, 151 candidates presented themselves, forty-six for Provisional Commissions, between the ages of nineteen and twenty-one, to compete for twenty vacancies; and 105 for the Practical class, between seventeen and nineteen, for forty vacancies. The Rev. Canon Moseley, in his Report to the Secretary of State for War, in speaking of the examination in mathematics, says:—

"Only 31 of 151 candidates afforded evidence of that degree of mathematical "knowledge to which the designation moderate was applied by the examiners, "and which was ranked by them as one degree above imperfect, and three "degrees below 'excellent.' The following may be taken as the type to this "degree of mathematical knowledge:—1st. To work an easy sum in arithmetic. "2nd. To demonstrate a proposition in the first book of Euclid. 3rd. To solve "an easy problem in Simple Equations. It was not that precisely this know-"ledge was exhibited by every candidate whose exercise was marked 'moderate,' "but that the knowledge so designated may be considered equivalent to it. "Nineteen provisional commissions were given, and thirty were selected for "the practical class."

Again, at the examination held in January 1856, fifty-eight candidates presented themselves, of whom twenty-seven were candidates for provisional commissions, and thirty-one for the practical class. Of the twenty-four to whom provisional commissions were given, two did not succeed in obtaining one-sixth of the total number of marks allotted to mathematics, and in accordance with the rule which had been laid down, should not have been allowed to count those marks. The questions put by the different examiners were generally easier than those given at the former examination.

Difficulty in obtaining the number of qualified candidates.

And yet notwithstanding that the questions set were easier, and the rules for the examination relaxed for the occasion, only one more than half the number required of qualified candidates were obtained; and the deficiencies of both these sets of selected candidates in Mathematics were so apparent on joining the Royal Military Academy, that instruction in that subject was at once provided, to teach them the knowledge which, in a School of Application, they are required at once to apply.

The standard of attainment in Mathematics, although slightly, was by no means materially higher at the last examination, in July 1856.

Large proportion of candidates that fail at Addiscombe.

We should also remark that for the very moderate entrance examination required to gain admittance into Addiscombe, the conditions of which are stated at p. 254, one-half of the candidates fail on their first trial, and one-third of the whole number examined are absolutely rejected.

pp. 324, 334, 347, 355, 366, 369, 376, 397, 412.

In addition to the necessity shown to exist for affording some instruction in theory, previous to calling upon the Cadets to devote themselves to the acquirement of practical knowledge, there are other reasons of much weight to be considered, which bear upon the question. It is maintained by a large number of Officers, that a course of Military Discipline and Training is almost of as much importance as the instruction; and that the daily parades, drill of various kinds, and the habits of implicit obedience to be thus acquired, will enable the young soldier to meet the duties of the Officer without any feelings of awkwardness or restraint, and leave comparatively little of the ordinary routine to be learned when the Cadet is transformed into the Officer. This Military Discipline and Training can be most advantageously imparted at a comparatively early age, when the Theoretical Instruction cannot be expected to have been fully completed: it is especially valuable to the young Engineer, who is so liable to be stationed apart from his brother Officers.

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The above considerations seem to us almost conclusive of themselves, against the possibility of establishing a mere School of Application without some preliminary training in a Military Academy. But let us for an instant refer to France. In that country, where the entrance examination to the Polytechnic is higher on the average in mathematics than the final one at Woolwich, and the number of successful candidates is very great, it is obvious that the reasons against commencing with a School of Application would be fewer than in England: yet we could not learn that many opinions in France were favourable to any such experiment. The large majority were undoubtedly desirous of retaining the Polytechnic as the best medium for imparting theoretical instruction; whilst others thought it possible that the Polytechnic could be dispensed with, but it was only on the supposition that the students were to be retained for a much longer period of time in the special classes of the Lycées and preparatory schools, or in the School of Application at Metz.

Practice in France.

pp. 14, 289.

See pp. 42–52.

The principal complaint at Metz, at the present time, is of the same kind that reaches us from Chatham, viz., that the young students from the Polytechnic do not draw sufficiently well, although they have previously passed two years at the Polytechnic; and a course of further instruction in drawing is accordingly continued at Metz.

In conclusion we should state, that to adopt such a method of training our Officers as that advocated by some, of taking them from public schools, &c., and sending them direct to a Practical Class or School of Application, would be to introduce a practice that is not at the present time in existence, as far as we are aware, in any foreign military system of education, and which would be open to peculiarly strong objections in the case of the Artillery and Engineers.

Having disposed of these preliminary questions, we shall now revert to the subject of the deficiencies which are said to exist, in the education of the Officers as conducted at the Royal Military Academy, and state,—

I. The causes which have militated against its success.

II. The remedies which should be applied to remove them.

III. The method on which we recommend the Royal Military Academy at Woolwich to be re-organized, and our proposals for its future system of instruction.

I. *Defects in the System and Management.*

DEFECTS IN THE SYSTEM AND MANAGEMENT.

As far as we have been able to ascertain, the principal defects that have been urged against the Royal Military Academy have been due to one or other of the following causes:—

1st. The juvenile age at which admission has been obtained.

2nd. The admission of insufficiently qualified candidates.

See p. 394, 400.

These defects are pointed out to us in the evidence we have received, but we are disposed to add the following, as being almost of equal importance to either of the preceding.

3rd. The very great variation in the duration of the residence at the Academy.

4th. The want of a properly constituted body for representing the defects in the existing system and course of instruction, and for suggesting ameliorations to meet the requirements of the Public Service.

Evil effects of the very early age of admission.

1st. Under this head, we believe, there is now no doubt that the admission of boys of the age of fourteen to sixteen years has led to much of the bullying which has at various times been complained of, and which, it is well known, is found to exist in all large schools to a greater or less extent. Thus we even heard of it in the Special Military School at St. Cyr, in France, (where the minimum age for entrance is seventeen,) and at the Cadet Houses in Prussia. This has probably been aggravated at Woolwich by the regulations under which, some Cadets have obtained their Commissions in less than two years, whilst others have remained more than five, and by the difficulty which has sometimes been experienced from the permission granted by the Master-General of the Ordnance for offending Cadets to return to the Academy, after

See pages 395, 399, 411.

he had directed their removal from it. This permission has undoubtedly proved at times a "stumbling-block" to the authorities at the Academy who have been endeavouring to enforce a sufficiently strict system of discipline. Colonel Portlock states: "The difficulties of the Academy are really due to the ages of "the Cadets, and the unfitness of a purely military system for managing them." Such also is Major-General Lewis's opinion, as he says, in a paper addressed to Mr. Monsell, in June 1855:—"If there is a serious fault in the existing Establish- "ment, it lies in the early age of the Candidates sent for admission. The "minimum age should be sixteen, when much time would be saved in teaching "the Elementary part of the Course."

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Vide p. 400.

2nd. The admission of unqualified candidates has, we are informed by one of the former Inspectors (Major-General Jones, Royal Artillery), led to "the time "of the Masters for the first year being occupied in imparting the very "rudiments and elementary knowledge of the subjects they ought to have "soundly known on joining, which leads to so many being removed at the pro- "bationary examination twelve months afterwards; and the valuable time of "the Masters is thus occupied when they should have been engaged in carrying "them forward in the course."

Injurious effects of the admission of unqualified Candidates on the Instruction.

See p. 394.

It appears that the number removed annually for incapacity has varied very considerably, and that such removals have taken place at very irregular periods of the Cadets' residence. Thus we find that:—

Numbers removed for incapacity.

Vide pp. 385, 386.

In 1841, 20 were removed; 11 at the end of 4 months for "general deficient progress," and the others at the end of the year.
„ 1842, 8 removed; one half at the end of 10 months, the others within 2 years 7 months.
„ 1843, 2 removed; one for "spelling and writing."
„ 1844, 9 removed; all, with the exception of 2, at the end of their year's probation.
„ 1849, 10 removed, mostly within 15 months after joining.
„ 1850, 17 removed; and of these 9 were for "general deficient progress," who had been 2 years 7 months, or more, at the institution; the others within 1 year 7 months.
„ 1851, 11 removed, of whom 5 had been 2 years 7 months, or more, at the institution, and were sent away for "general deficient progress;" the others within 1 year 7 months.
„ 1852, 8 removed, of whom one half had been 2 years 1 month at the institution, and were removed for "general deficient progress," and the remainder within 1 year 7 months.

We cannot here avoid incidentally remarking, that, if the Entrance and Probationary Examinations had been efficient, we are at a loss to understand how it became necessary to remove so many Cadets for "general deficient progress," after they had been more than two years at the Institution; or why one should have been obliged to quit for "spelling and writing."

Failure of the entrance and probationary examinations.

But if any further proof were required that insufficiently qualified or insufficiently gifted candidates had been admitted in large numbers into the Academy, it would be deducible from a comparison of the numbers admitted since 1825, with the number commissioned in the Royal Artillery and Engineers. Thus we find that between 1825 and 1849, both years inclusive, 1,296 Cadets were admitted into the Academy. None of those admitted in 1825 obtained their commissions before 1827; and reckoning from that year down to 1854 inclusive, 968 Cadets obtained commissions in the Artillery and Engineers, the difference between the numbers admitted and commissioned being 328; so that more than 25 per cent. of those admitted did not obtain Commissions in the Ordnance Corps: and this is rather understating than overstating the case.

Vide p. 384.

Having thus established the fact of the admission of a very large number of unqualified candidates, we shall now endeavour to trace the evil to its source, and learn in what manner it has happened. It is manifest that the entrance of unqualified candidates can be only due, to the insufficiency of the entrance examinations: and their long continuance in the Establishment, to defects in the working of the Probationary Examinations.

We have recently applied to the Governor of the Royal Military Academy for information respecting any modifications that may have been made in the conditions of the entrance examinations subsequent to the issue of the printed regulations of 1848, and also as regards the system of decimal proportions determining the epithets "not qualified," "partially qualified," "qualified," "well

DEFECTS IN THE SYSTEM AND MANAGEMENT.

qualified," "very well qualified," as applied to the admission of candidates. We have also asked for information regarding the past working of the Probationary Examinations. But the pressure of business on the recently appointed authorities at Woolwich Academy is so great, that the returns and information asked for could not be supplied. The information we have obtained on this subject has, therefore, been derived from Colonel Portlock, who until very recently filled the office of Inspector, and who has given us much valuable information on most subjects connected with the Royal Military Academy and the Corps of Engineers.

Under the system of entrance by nomination, rigid examinations cannot be maintained.

With regard to the insufficiency of the Entrance Examinations we must observe that under any system of entrance by nomination, it is not to be expected that a rigid examination prior to admission could be long upheld. By the Regulations for Woolwich Academy, dated 1848, the entrance examinations are directed to be of a searching character, and yet Colonel Portlock informs us that "although he considered those regulations nominally quite sufficient to "insure a good selection, they have been successively frittered down to "meet the views of influential complainants; and that rigid examinations "could scarcely be expected to exist simultaneously with patronage, as the "principles of the two are antagonistic. What favour would it be to a "powerful applicant to give a nomination on the one hand, and to cancel it on "the other, by a too stiff examination?" And he adds, "We ought to "wonder that so good a selection was made under such a system."

Entrance examinations gradually made less strict.

Working of the probationary examination.

The working of the probationary system of examinations appears to be as follows:—

At the end of the year the *Masters* in the several class-rooms make out a return of the Cadets that are unlikely to qualify in Mathematics and Fortifications, a return founded partly on the periodical examinations, and partly on their previous knowledge of the Cadet's abilities. These Cadets are then brought before the Probationary Board, consisting, as we have already stated, of the Lieutenant-Governor, Inspector, and Assistant-Inspector, and re-examined by the Professors of Mathematics and Fortification, (whose instruction is usually limited to the most advanced Cadets,) who give a few questions, written and vivâ voce, seldom of a severe character; and thus the deliberate opinion of the real judge in the class-room (*the Master*) is, *in about three cases out of four*, reversed by this meagre and most unsatisfactory test of the Board. In Geometry this is almost ridiculous, for whilst in the class-room the solution must be *written down* unaided by anyone, the *vivâ voce solution* is given under the frequent corrections and prompting of the Professor, so that failure in Geometry can only very rarely occur.

It can scarcely be questioned that the proper duty of the Probationary Board should have been to examine the Class-room Examination papers; to give additional questions only in doubtful cases; and then to certify that the proof of incapacity appeared to them sufficient or otherwise.

Ill effects of the uncertain duration of the residence.

3rd. We are disposed to think that the great irregularity in the duration of the residence at Woolwich has been productive of more serious ill consequences to that Institution than any other cause with which we are acquainted. The great inequality in the ages, and length of residence of the Cadets, has augmented the tendency to bullying, and often been the means of repressing the desire to study on the part of the junior Cadets, as among the seniors are usually found those who have continued longest at the Academy from incapacity or idleness; and as this inequality is entirely in opposition to the almost universal practice followed in nearly all Foreign Military schools, we are at a loss to understand how it has completely escaped animadversion. It amounts to nothing more nor less than offering a premium to idleness and inattention.

The effect of such a system will be made more apparent by our exhibiting the *average* length of time that each batch of Cadets which has been commissioned since the year 1841 has remained at the Academy, as well as the *greatest* and *least* time of residence of any Cadet belonging to the same batch, and the *average* age of those commissioned during each year, prepared from Table G. p. 391, by which it will be seen that the *difference in the length of the residences* of Cadets belonging to the same batch *usually amounts to* $1\frac{3}{4}$ *years*.

Year and Month.	Number of Commissions.	Time at the Academy for each batch.			Average Age when commissioned.	Remarks.
		Average.	Greatest.	Least.		
		Months.	Months.	Months.	Yrs. Ms.	
1841. June - -	18	38.	49.	25.	18 5	
1842. Jan. - -	22	39.0	47.	29.	18 8	
„ June - -	18	33.5	49.	22.		
1843. Jan. - -	16	34.5	56.	26.	18 6	
„ June - -	20	33.4	49.	24.		
„ Dec. - -	22	36.0	46.	28.		
1844. June - -	20	37.9	52.	28.	18 8	The Practical course occupied about 6 months during this period.
„ Dec. - -	20	39.8	52.	31.		
1845. June - -	15	39.2	49.	28.	18 9	
„ Dec. - -	20	40.6	52.	28.		
1846. May - -	21	43.0	54.	36.	18 11	
„ Aug. - -	23	38.5	54.	27.		
„ Dec. - -	20	38.8	52.	25.		
1847. May - -	22	37.2	51.	24.	18 8	
„ Oct. - -	41	35.8	59.	20.		
„ Dec. - -	39	27.0	43.	20.		
1848. June - -	20	26.1	40.	23.	18 0	
„ Dec. - -	20	25.7	32.	23.		
1849. June - -	20	30.6	38.	25.	18 5	
„ Dec. - -	19	36.1	44.	29.		The Practical course occupied about 12 months during this period.
1850. June - -	21	41.6	61.	35.	18 7	
„ Dec. - -	20	41.4	47.	37.		
1851. June - -	15	41.1	53.	37.	18 3	
„ Dec. - -	21	46.0	57.	34.		
1852. June - -	19	53.7	59.	43.	19 1	
„ Dec. - -	20	52.4	61.	43.		
1853. April - -	2	56.0	56.	56.	18 11	
„ June - -	15	50.0	67.	43.		
„ Dec. - -	18	52.8	61.	43.		
1854. April - -	16	49.6	59.	41.	18 5	The Practical course occupied from 5 to 9 months during this period.
„ Aug. - -	22	46.4	63.	36.		
„ Oct. - -	22	40.3	47.	29.		
„ Dec. - -	10	29.5	47.	22.		
1855. Feb. - -	27	33.6	43.	24.	17 1	The Practical course occupied from 3 to 4 months during this period.
„ April - -	20	24.7	39.	15.		
„ Aug. - -	18	22.0	33.	14.		
„ Oct. - -	8	30.6	37.	26.		
„ Dec. - -	10	28.6	33.	22.		

Variation in the duration of the residence at the Academy.

We consider that the admission of batches of Cadets should take place at certain stated periods, previously made known to the public generally, and that all who are admitted at the same time should thus run the same race under precisely the same circumstances, and should quit the Academy together. Those gifted with superior talent, and possessing powers of using it by continued application, would then receive the full reward of their ability and perseverance.

Necessity for stated periods for entering and leaving the Academy.

Under the system which has hitherto prevailed at the Royal Military Academy this has not been the case. The Cadet of eighteen months or two years' standing has had for his closest competitors, in numerous instances, those who have been more than double that time under the instruction of the same Professors and Masters. The manifest injustice of such a system is too glaring to require further comment.

4th. The want of a properly constituted body for representing the defects in the system of management and course of instruction at the Academy formerly obliged the Master-General of the Ordnance, from time to time, to appoint Committees of Inquiry, and in many instances these Committees investigated the subject-matter of complaint, without the authorities at Woolwich Academy being made aware, except by inference, of the objects of the inquiry.

The want of this body for representing defects led to the appointment of Committees of Investigation.

The remedy applied was almost as bad as the disease, as it was sometimes left uncertain whether the conduct of the authorities or that of the Cadets was under investigation.

Injurious action of such Committees. pp. 395. 401, 413.

The action of such Committees is necessarily irregular, and can only refer to specific acts, or to particular circumstances, occurring at particular times; and it is essentially different in effect from the continued and sustained influence which the Boards of Improvement in Foreign Military Schools exercise on the system and course of instruction carried on in these establishments.

Had any properly constituted body been in existence, whose duty it would have been to have pointed out to the authorities the shortcomings of the Royal Military Academy, we consider that the preceding defects would long ere this have been completely remedied. The composition of such a body is, of course, of the greatest importance, so that on the one hand it should not be repeatedly trying experiments on the Instruction at the Academy, whilst on the other it should not be deterred from making representations, which would prove advantageous to the service.

Necessity for a well-constituted Board of Improvement.

REMEDIES FOR THE DEFECTS IN THE SYSTEM AND MANAGEMENT.

II.—*Remedies for the Defects in the System and Management.*

Having thus briefly pointed out the defects of the system pursued at Woolwich Academy, we shall now proceed to suggest the alterations that should be made to correct these defects, in the same order as we have followed in enumerating them.

Alteration in the age for admission.

1st.—The obvious remedy for the too early age of admittance, is that which the Secretary of State for War has already determined on, viz. to raise the age of admittance; and the *only* question that arises is, whether a slight alteration might not advantageously be made in the limits of age suggested.

The effects of raising the age, that the education, and the aggregate of talent will be greater.

a. It is probable that the immediate effect of raising the age for admission into the Royal Military Academy from 14–16 to 16–19 or 17–20 will be, that a considerable proportion of the successful candidates may be expected to possess a larger amount of general education than under the preceding system of admission as mere boys.

b. It is almost certain, that the aggregate of talent obtained from the system of admission by open competition will be greater than under the system of nomination and examination which has hitherto been pursued.

c. But we do not think that it is by any means clear that *higher*, or even as high talent, will be obtained for the Scientific Corps, if the ages for admission be fixed at either 17–19 or 17–20, or any more advanced age, as would be secured by fixing the age for admission at 16–19.

Considerations in favour of fixing the limits of age at 19 for the upper and 16 for the lower limit.

In this country there is a very strong opinion, possibly amounting even to a prejudice, existing in the minds of parents in favour of placing their sons early in life in some profession or occupation; and many parents who would be anxious to allow their sons to compete for admission to the Royal Military Academy, between the ages of sixteen and seventeen, will not keep them unemployed beyond that age. Whilst as regards young men of superior ability, the sons of persons in opulent circumstances, between seventeen and twenty, if their ability be very well ascertained and thoroughly developed, it is likely they will look to other professions that hold out greater prizes than the Artillery and Engineers do for a successful career. And our argument in favour of sixteen as the lower limit is, that boys of that age that can successfully compete in a severe examination with others of a riper age are well worth having.

We do not think the number that would enter under seventeen would be very *numerous*, but we feel assured they would be very *eligible* candidates in *point of talent.*

In the Evidence forwarded to us, although no questions were asked on the subject, the preponderance of opinion is most undoubtedly in favor of an earlier age than 17-20. Thus we find that Sir Hew Ross "would regret if, under "the new system of competition, Officers were to receive their first Commissions "at a more advanced age than nineteen or twenty. It would proportionably "be to their disadvantage and to that of the Service." This would necessitate their entrance into the Academy before eighteen. Major-Gen. Chesney, R.A., names 17-19; Colonel Barker, R.A., 16-18; Major Charters, R.A., 16-18; Captain Shakespear, R.A., 16; Major-Gen. Lewis, R.E., names 16; Lt.-Colonel Larcom, 16; Lt. Colonel Burgmann, R.E., 16-17; Captain Galton, R.E., 17-19; and Captain Scott, R.E., 17; while Colonel Wilford, R.A., and Captain Younghusband, R.A., advert to 17-20 having already been decided upon, without offering any opinion on the subject. But in no instance is so late an age as 20 absolutely recommended as the upper limit.

Consistent with the fact of their having had a good general education, we are of opinion that it will be advantageous to have the great bulk of the successful candidates under eighteen years of age, but we suggest nineteen as the upper limit, as that age will allow the large mass of the young men quitting the Public Schools for the Universities to become candidates.

Remedy for the evils due to the admission of unqualified Candidates.

2nd. The proper remedy for the evils experienced from the admission of insufficiently qualified candidates is that which has already been determined upon, viz.: the admission of candidates to be made dependent on the results of an open competitive examination, conducted with the most perfect fairness to all concerned. The Probationary Examinations should be entirely done away with, and the Cadet should be considered as liable to removal for want of capacity or for want of proper application at any period during his residence; and the half-yearly examinations will furnish the best possible means of ascertaining whether any deficiencies of the kind alluded to do exist.

Woolwich Academy.

Colonel Barker, however, states, "That he cannot help thinking the system "of opening the public examination for admission to the Regiment to all classes "without distinction, extremely objectionable; and he therefore recommends "that all Candidates for Commissions in the Royal Artillery should be nomi- "nated as at present for the Royal Military Academy, by the Secretary of State "for War, or by the Commander-in-Chief." We are, therefore, obliged to advert to the subject at some length.

Open competitive examinations.

Objections entertained to the same. p. 335.

We are quite ready to allow that if, in the course of our inquiry into the foreign military systems of education, we had ascertained facts that bore hardly upon the results of such open competitive examinations, it would have been our duty to have given such facts full consideration, and to have brought them specially into notice; but in the absence of such facts, and with the very decided impression on our minds that in those Foreign Schools which bring the principle of competition most fully into play the instruction is most complete; and in the presence of that which is perfectly well known to all, that success at our own Universities (usually the forerunner of after success in various professions in life), is the result of open competitive examinations, not limited to any nominated set of candidates, or confined exclusively to the higher or opulent classes, we are at a loss to understand the exact bearing of the objections entertained to open competition.

Evidence furnished by the results of competition in Foreign Schools

At the same time that we contend for the advantages of open competitive examinations, we are bound to say, that we think unusual care should be taken in making inquiries into the previous character and conduct of the candidates; and also, that they should clearly understand that, during the period whilst they are under instruction, their conduct will be most carefully scrutinized, and that serious irregularity of behaviour will be considered a sufficient ground for withholding a Commission.

See pp. 319, 323, 353, 357, 366.

3rd. The simple remedy for the injurious consequences attendant on the great irregularity in the duration of the residence at the Academy, is to change the practice, and follow that adopted at most Foreign Military Schools, by fixing a certain period during which *all* Cadets who enter the Institution *must remain*, and *none* should exceed, except in the case of severe and continued illness.

Remedy for irregularity in the residence.

We shall defer the consideration of the actual duration of residence that will be necessary, as it must depend entirely on the nature and extent of the course of studies proposed to be pursued, and the degree of proficiency which the candidates may be expected to have attained when they are admitted, until we have discussed these subjects.

4th. We recommend the appointment of a Board of Improvement, consisting of the Governor, the Inspector of Studies, the Officer commanding the Cadet Company, the Professors of Mathematics, and Fortification, and the Instructors in Practical Artillery and Surveying, in addition to an Officer belonging to each of the Corps of Artillery and Engineers, to be appointed by the Secretary of State for War, to represent the wants of each service, as made apparent by any deficiencies in the instruction at the Academy, exhibited by the young Officers on joining at Woolwich and Chatham.

Appointment of a Board of Improvement.

This Board to meet twice a year, immediately after the half-yearly examinations, under the Presidency of the Governor, or, in his absence, of the Inspector of Studies. Five members to form a quorum.

The principal duty of this Board will be to make Recommendations relative to alterations in the Programmes of the Entrance Examinations, and to suggest ameliorations in the Course of Studies to be followed in the Academy.

Duties of this Board.

III.—*Recommendations for the future System of Management and Instruction at the Royal Military Academy.*

Having now fully discussed the question relating to the joint education of Cadets intended for the Artillery and Engineers; having considered the expediency of doing away with theoretical instruction; and having investigated the causes which have hitherto operated unfavourably against the Royal Military Academy, and pointed out the principal remedies which should be applied; we must observe, that all our conclusions show that there is no difficulty involved in a re-organization of the Institution.

We have already stated that we have felt ourselves precluded by the nature of our instructions, from entering into the question how far it might be

Remedies for the Defects in the System and Management.

judicious, in re-organizing the training of Officers of Artillery and Engineers, to adopt any of the schemes which have been suggested for combining their Education with that of the rest of the army; and we still think, that if any such projects are contemplated, the assistance of Officers belonging to the other branches of the Army or to the Staff, should be given to enable the subject to be properly considered, as there is a good deal to be said both in favour of and against joint education. We have elsewhere dwelt strongly on the fact that neither France, Prussia, nor Austria have adopted it.

We have, therefore, now only to particularise the mode in which the remedies should be applied, and the alterations that should be made in the existing educational system.

We shall divide the subject into the following heads:—

1. Subjects of Entrance Examination.
2. Manner of conducting the Examinations for Admission.
3. Number of Examiners required.
4. Course of Instruction in the Academy.
5. Method of conducting the Periodical Examinations.
6. Period when the selection of the Service should be made.
7. Additional facilities required for the Instruction and for the maintenance of the Discipline.

1. *Subjects of Entrance Examination.*

Subjects required for the Entrance Examination.

With regard to the branches of study in which Candidates should be examined for admission into the Academy, we are of opinion that such only should be selected, as will allow the Examiners to ascertain that the candidates possess ability, and sufficient knowledge of certain subjects to enable their professional education to be advantageously carried forward from the moment of their admission, and which will also show that they have received the usual education of a Gentleman in England.

But we entertain very great objections to the Examinations being allowed to extend to a large number of subjects, as the effect of such a system is generally to produce slight and superficial knowledge in all.

We are desirous of supporting our opinion by quoting the following strong expressions from the Rev. Canon Moseley's last report of the Examination for Appointments, held at King's College, dated 1st September 1856:—

"In my last report I expressed to your Lordship a hope that the tendency "to diffusive reading, of which the first examination afforded the evidence, had "been checked. I regret that this hope has been disappointed, as the candi- "dates are reading more diffusely than ever.

"No less than 18 per cent. claimed, each, to be examined in eight different "subjects; 19 per cent. in seven, and 21 per cent. in six. Reading spread "over so large a surface cannot but be, for the most part, without depth; nor "is the mind likely to be well disciplined which, passing from subject to subject, "gathers up fragments from each, but encounters the real difficulties of none."

For these reasons we limit the number of subjects which *must* be brought up for examination to four; and in order to afford direct encouragement to the candidates presenting themselves from three very different classes of schools, viz., the Classical, Foreign, and Scientific, we propose to allow them to choose two out of four other subjects.

We think the subjects absolutely required for the Entrance Examination should be, (1.) Mathematics, Pure and Mixed, as the groundwork on which the greater proportion of the scientific professional education is to rest. (2.) The English Language, Literature, and History, and General Geography. (3.) The French Language and History; and, (4.) Drawing; and we propose to allot the following number of marks to these subjects:—

	Marks.	Marks.
Mathematics, Pure	2,000	3,500
„ Mixed	1,500	
English Language, Literature, and History	1,000	1,750
General Geography	750	
French Language and History ...	1,000	1,000
Drawing	1,000	1,000
Total		7,250

In addition to the preceding, in accordance with the principle we have stated, the Candidates may, if they choose, select any two of the following subjects:— Woolwich Academy.

Optional Subjects.

Latin	1,000	marks.
Greek	1,000	„
German	750	„
Experimental Sciences	1,000	„

We recommend, with reference to the subjects which are obligatory:— Minimum qualification in Pure Mathematics, English, French, and Drawing.

(1.) In order to secure that the Cadets, on entrance, shall be thoroughly grounded in Elementary Pure Mathematics, that a very large proportion, say five-sixths, of the whole number of marks should be assigned to the following subjects, viz., Arithmetic, Algebra to Quadratic Equations inclusive, Geometry, the first six books and the first twenty-one propositions of the eleventh book of Euclid, the Elements of Analytical Geometry, Plane Trigonometry, and the use of Logarithms; and that no candidate shall be eligible to be admitted unless he obtains one-fourth of the number of marks allotted to Pure Mathematics.

(2.) That on account of the importance of English and Geography, French and Drawing, as regards the future progress in professional knowledge, no candidate shall be admitted to the Academy unless he obtain one-fourth of the total number of marks allowed for these subjects.

And further, with reference to any of the remaining subjects, that no candidate shall be permitted to count the number of marks gained in any other subject, unless that number exceeds one-fifth of the total number of marks allotted to that subject.

It will be noticed in the scale of marks for the various subjects, that we have increased those allotted to the English language, literature, and history, and general geography, from 1,250 (sanctioned by the provisional arrangements) to 1,750, and also those for drawing from 750 to 1,000. We have been induced to make these alterations from the fact, very apparent in many recent examinations, besides those for Woolwich, that in our public schools the teaching of English and arithmetic, to say nothing of the higher branches of Pure mathematics, are at present generally neglected, whilst little or no attention is paid to drawing. Thus, during the year 1851 to 1854 inclusive, 437 gentlemen were examined for direct commissions in the Indian Army. Of this number, 132 failed in English, and 234 in arithmetic. The defects in the Woolwich examinations have been similar. By reference to the Rev. Canon Moseley's last report to the Secretary of State for War, dated 1st September, on the third competitive examination for Commissions in the Artillery and admission to the Royal Military Academy, it will be seen that the Mathematical Examiners report that the faults are,—"1. A general want of precision and accuracy in "numerical computation. 2. A general ignorance of the use of logarithms." Again, in English literature, the Dean of Westminster says,—"I wish I could "report more favourably about the papers than I can. Mr. Clough writes to "me,—'My impression is, that there has been a good deal of reading of short "'summaries and cramming books, but that there is not much real study.' And "again,—'There is a great deal of mediocrity in my papers.' I am compelled "to agree with him in both statements." The Examiners in the Experimental and Natural Sciences, among other remarks, say,—"The spelling of the candidates "needs especial notice, in many cases it is exceedingly defective." Finally, the Examiners in Drawing, notice a considerable falling off in the amount of information displayed when compared with the last examination, and they add,—"The "chief cause of the failure may undoubtedly be found in the fact that the number of marks allotted to this branch in the last prospectus was not sufficient to "induce men to turn their attention to a study, comparatively new to many of "them, notwithstanding its immense importance in the event of their being "successful; as the absence of moderate skill in this branch greatly retards progress in any of the practical and technical studies, and consequently often has "a very injurious effect on the ultimate position of those who are thus deficient."

p. 303.

We have not placed Latin and Greek among the subjects absolutely required, because a knowledge of the Classics, however valuable, is not absolutely essential to the Cadet's Professional Instruction, whilst English, French, and Drawing are all indispensable.

2. *Manner of conducting the Examinations for Admission.*

Mode of conducting the Examinations.

We are of opinion that it would be desirable that all the Examinations should be conducted on an uniform plan, and on the same principles; not only those for the admission of candidates to the Academy, but also the subsequent periodical examinations for the arrangement of the Cadets in the order of merit. This is not the case at present.

We should shortly state, that our attention has been directed to two essentially different systems of examination.

The first, similar to that under which the recent competitive examinations have been conducted, consists in placing before the candidates at each sitting as many separate papers of questions as there are Examiners in the subject, one paper being prepared by each Examiner. Each paper contains a certain number of sections, with three distinct questions in each section, arranged in the order of their comparative difficulty, and the candidates are directed to answer only one question belonging to each section.

Each Examiner looks over and awards marks only for the replies given to his own questions; and hence it frequently happens that a candidate obtains a considerable number of marks from one Examiner and none from another, *one judgment* only being brought to bear on each paper. The mean of the marks awarded by the several Examiners is, of course, used.

The other system is nearly identical with that commonly followed in some of the Examinations at the Universities, and at Public Schools. It consists in placing a paper of questions, which has been conjointly drawn up by the Examiners, before the candidates, and in causing the Examiners in succession to give their opinion on the quality of the replies. By this process *two or more judgments* are brought to bear on precisely the same facts.

We consider the last system to be preferable to the first.

Accordingly, we recommend:—

(1.) That the number of marks allowed for each branch of study should be divided among the particular questions proposed to be given, so that each question should have its number of marks assigned to it before the examination is commenced: the number depending on the difficulty of the question, or the importance of the principle involved.

Course to be followed when there are more than one Examiner.

(2.) When more than one person is appointed to examine the Candidates in any particular branch of study, the paper of questions proposed to be placed before the Candidates should be conjointly drawn up by the two or more Examiners, and the marks allowed for each question should be entered on the Candidate's paper.

(3.) The written replies to the questions in each subject given in by the various Candidates, should then be successively submitted to the judgment of the Examiners, who will each separately, and without conferring with each other, make out a list, on forms specially prepared for the purpose, of the marks he has awarded for the reply to each question, and give in such forms to the person appointed to arrange the whole examination. The number of marks awarded is not, however, to be entered on the Candidate's paper of replies.

In this way different judgments will be brought to bear on the *same facts;* and not (as the examinations are at the present time provisionally conducted) different judgments on *entirely distinct sets of facts.* Deductions may then be safely drawn as regards the relative judgments of the various examiners, but at present no comparison can be properly made.

The effect of conducting the examination on this system will probably be to ensure very great attention and discrimination on the part of the Examiners.

The Candidates should be distinguished by numbers as at present arranged.

The entrance examinations should be under the control of the Educational Branch of the War Department.

Free places to the two first, and semi-free places to the two next of the successful candidates

In order to encourage emulation, and to induce the Candidates to come up well prepared for these Examinations, we recommend that provision should be made in the Army Estimates for granting to the two who stand first on the list of the successful Candidates at each Entrance Examination *free* places in the Royal Military Academy, and that the two next in order of merit should only pay half the contribution which would otherwise be required from them.

3. *Number of Examiners required.*

WOOLWICH ACADEMY.

We recommend that:—

Number of Examiners.

Two Examiners should be appointed for Mathematics
Two for the English Language, Literature and History, and General Geography.
Two for the Classics.
Two for French and German.
Two for Drawing.
One for the Experimental Sciences.

So that the judgment of two Examiners will be brought to bear on all subjects in which a minimum qualification is exacted.

And that the appointment of Examiner should not be held for a longer period than three years, and that none should be immediately re-appointed.

It will be observed that in making these recommendations, we have largely diminished the number of Examiners required for conducting the entrance examinations compared with the number hitherto employed; but when we remark that five Examiners conduct the whole of the examinations for admission to the Polytechnic, where the number of candidates probably amounts to three times the number that will compete for entrance into the Royal Military Academy, it will be apparent that we have not unduly reduced the number in limiting them to eleven.

Time occupied.

Assuming that a sufficiently searching examination can be made in the course of a day of six hours for the accurate apportionment of 1,000 marks,—

The examinations in	Mathematics would therefore occupy	-	3 days.
„	Classics „ „	-	2 „
„	English and Geography „	-	2 „
„	Drawing - - - „	-	1 „
„	Experimental Sciences - „	-	1 „
„	French and German - „	-	2 „

And we are of opinion that the examination in the subjects which are absolutely required, should precede those which are only optional.

We cannot, moreover, conceal from ourselves that the payment for these examinations has hitherto been exceedingly liberal, and we believe that 50*l.* for each examination to each Examiner would be ample, except possibly for those conducting the examinations in mathematics.

4. *Nature and Course of Instruction in the Academy.*

In the last few pages we have considered the best system of examination for entering the Academy. We must now turn to the course of instruction to be given within its walls.

Previous to the recent alterations the Academy contained about 200 Cadets, divided into *four* classes for theoretical and *one* for practical instruction. To each of these, except the practical class, a separate room was allotted, and the instruction was (and still is) given on the system of *lessons* so common in our public schools, and not on that of *lectures* which we found existing in the Polytechnic School and in some of the Prussian and Austrian Military Academies, and which is made so effective a method of teaching in the Scotch Universities. The immediate effect of reducing the period to be spent at the Academy from *five* to *two and a half* years will be the diminution of the number of Cadets to a hundred and thirty-five. On what principles, then, are these pupils to be instructed? in large or in small classes? by lessons, as at present, or by professorial lectures?

System of Lessons and that of Professorial Lectures.

We have seen, and shall describe fully, both the excellence and the weakness of professorial teaching in the Polytechnic,—its excellence in the superior character of the lectures given by Professors who can devote abundant time to their preparation; its weakness in attempting to give exactly the same teaching to large numbers of pupils of very unequal abilities. The Polytechnic, however, is altogether an exceptional School, and in this particular point many reasons (alluded to elsewhere) would prevent us from making it our model. In Prussia and in Austria the less ambitious process of ordinary lessons,—such as are found in all our own schools,—is very efficiently worked; but in both countries,

Some Amount of Professional Lectures desirable.

particularly in the last year or two of a student's career, these lessons are raised into something more like a Professor's lecture, the teaching is less of a drill, and greater demands are made on the energy and intelligence of the pupils to meet and to apply for themselves the instruction of the Professor. The lectures we heard in the Artillery and Engineer School in Berlin, and in the Staff School in Vienna, were both of this character; the Military Professor gave a continuous discourse, and from their notes and their own reading, the pupils were expected to master the subject for themselves. The cross questioning of the Professor and the rapid continuous replies of the pupils, in a lecture on Military History in the Staff School at Vienna, showed how admirable an exercise such a lecture might become.

We consider the principle referred to a good and natural one,—to make *lessons* the staple mode of teaching during the first period, and in the second year to introduce some amount of Professor's *lectures;* and we shall make proposals in the following detailed plan of studies for carrying out this suggestion.

Importance of attaining facility in the taking of notes.

It is of great importance that the Cadets should be accustomed to acquire a portion of their knowledge by the aid of notes taken at the time, and perfected immediately after the Professor's lectures; and we are of opinion that the preparation of such notes should form a weekly exercise, and receive marks which should tell upon the examinations. The attainment of facility in this class of work cannot fail to be of advantage to the Cadets in their after career.

With regard to the *lessons* to be given, it must be remembered that each fresh batch of Cadets may contain great differences of ability,—and we think the present plan of dividing the pupils of each admission into two classes a very good one. These classes may be small, but what is lost in this respect in point of emulation, will be gained (particularly in the earlier part of the studies) by the extra care with which the Master will be enabled to meet the wants of individual pupils.

p. 414.

In carrying on the teaching, we entirely agree with Professor Sylvester, that "it would be desirable to introduce a break into the present long sittings at "Mathematical study, which extend over three continuous hours in the morning, "and two and a half hours in the afternoon of the same days," and consider that no lesson whatever should exceed two hours in duration.

p. 383.

The instruction in the different branches of study should also be more equally divided throughout the week than has hitherto been the case; Mathematics having been limited to the three first, and fortification to the three last days of the week.

p. 295.

It is obviously undesirable that fourteen hours of Mathematical teaching, given by one Professor and Master, should be crowded into three days.

Teaching of French and German.

p. 361.

It is advisable that not more than four hours a day should be devoted to any one subject of study, and Lieutenant-Colonel Bainbrigge has justly drawn attention to the fact that, in the teaching of the German and French languages, which we propose should be continued for the same amount of time during the three first terms and for a diminished time for the two last, conversation or repeating sentences aloud should be insisted upon.

Subjects of instruction during first half-year.

With regard to the actual course of studies to be pursued, we propose, that during the first half-year or term, the main object of the instruction should be to perfect and extend the students' knowledge of Mathematics, commencing at Trigonometry, and to begin regular courses of instruction in Descriptive Geometry, Geometrical, Plan, and Landscape Drawing, as a basis on which the future instruction in Fortification and Military History should be founded, and also to give instruction in French and German.

Second half-year.

During the second half-year, the number of hours devoted to Mathematics, Plan and Geometrical Drawing, and Descriptive Geometry may be diminished. The study of Military History and Fortification should be introduced.

p. 398.

On the whole, there appear to be grounds for agreeing with Colonel Portlock in thinking that the teaching of Elementary History and Geography should be abandoned, although the results of the recent competitive examinations would seem to throw some doubt on the propriety of doing so; and these subjects should be replaced during the second half-year or term, by Lectures on Military History, involving a consideration of the physical features of countries, as bearing on the movements of Armies.

Third half-year.

In the third half-year or term, the time devoted to Mathematics may be still further diminished, and be principally given to lectures by the Professor on

Woolwich Academy.

the higher branches of Mathematics to such of the class as are capable of following him, and to the repetition of parts of the course to such as are not: the time allotted to Plan and Geometrical Drawing and Descriptive Geometry should be lessened, and additional hours spent in Fortification; and the Cadets' attention should now be devoted to Architectural and Machine Drawing, and to Lectures in Chemistry and Natural Philosophy.

Fourth and fifth half-years.

In the fourth and fifth half-years or terms we propose that Plan, Geometrical, Landscape, Architectural, and Machine Drawing shall be given up, and only employed where necessary in carrying forward the other subjects of instruction; that Mathematics and Fortification shall each be limited to a professorial weekly lecture on the higher subjects and applications in the former science, and be made to bear more especially on the Art of War in the latter. Lectures also in Natural Philosophy, Chemistry, Practical Mechanics, Machinery, Metallurgy, Geology and Mineralogy, should be given, those hitherto devoted to Practical Astronomy being omitted on account of want of time. The staple subjects, however, for these two terms, should be Practical Artillery, Surveying, and Field-works; a short course on the Tactics of the Three Arms being also introduced.

Error committed in entirely separating the Theoretical from the Practical Instruction.

With respect to the existing method of carrying on the instruction, we consider that a grave error has prevailed, in keeping the studies which are followed in the Theoretical class, entirely separate from those which are attended to in the Practical class.

The duration of the course of study in the practical class has latterly been one year, and during that time no steps have been taken to keep the knowledge acquired by the Cadets during their theoretical course of instruction alive and fresh in their memories. The Examinations made in the Theoretical class have been considered to be final and conclusive, not only as regards the position of the Cadets at the period of their entry into the practical class, but also as a true indication of their theoretical acquirements when Commissioned; since the marks they have gained at their final examination in the theoretical class, are carried on and added to those subsequently obtained in the practical class, for proficiency in very different branches of study.

By this entire break between the Theoretical and Practical classes the knowledge acquired in Mathematics, Fortification, &c., is allowed to lie dormant, become rusty, or even to be forgotten, before the Cadets are actually Commissioned and join their Corps.

Abolition of the separation between the Theoretical and Practical Classes.

We propose, therefore, to abolish the separation between the Theoretical and Practical classes, and to regard the Cadets at the Academy as a whole; the entire duration of residence being made two years and a half, or five half-yearly terms, of which the first three will be principally devoted to theoretical professional studies, and the last two to a combination, where theory and practice go hand in hand together. It would certainly be advantageous, instead of discontinuing all instruction in Mathematics and Fortification, greatly to curtail its length, and to give to what is still retained a practical bearing as far as possible; an opportunity would thus be afforded for bringing into play the voluntary exertions of the Cadets themselves, to retain and even to increase the extent of their knowledge in their various studies, a knowledge which should be tested by careful examinations at the end of each half year or term, in the manner we are about to describe.

Durationof residence.

It is quite possible that the period of residence may eventually (when the candidates from the Public Schools are found to be better prepared than at present) be reduced from two and a half to two years; but it will be perfectly easy to make such an alteration when it is ascertained to be feasible, and far better to do so than to commence with a course of two years' duration, and have subsequently to increase it to a greater length.

It is the more desirable to proceed cautiously in this direction, inasmuch as the effect of these alterations, if sanctioned, will be to change the number of Masters and Instructors required for carrying on the teaching in the several branches of study.

Thus, a less number of Mathematical Masters will be sufficient, in consequence of the considerable diminution in the hours devoted to that subject; two may probably be dispensed with, while it is likely that an additional Instructor will be required to teach Military History in connexion with Physical Geography and the Tactics of the Three Arms.

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A Lecturer will also be required in Natural Philosophy.

When it is found that the course can be limited to two years' duration, the number of Masters may be still further diminished.

5. *Method of conducting the Periodical Examinations.*

Examinations in the Academy.

We must now approach the subject of the examinations to be conducted in the Academy, the proper period for holding them, their nature, the manner in which they should be carried on, and by whom.

Foreign methods of conducting the Interior Examinations. p. 22.

France.

In France, in the Polytechnic School, the examinations at the end of each year, are conducted entirely by Examiners who have no connection with the School; but, it must not be inferred that the position of the students is solely determined by their awards. It is elsewhere fully shown in the account of that important School, that other examinations, occurring continuously throughout the year, are carried on by the Professors and their Assistants the *Répétiteurs;* and the combined result of the whole system is, that the marks awarded by the Professors and *Répétiteurs* exercise much more influence on the position of each student in the classified list, than those finally given by the Examiners, who are strangers to the School. The same system is followed in the School of Application at Metz, but with different proportions as regards the amount of influence exercised respectively by the Examiners and Professors.

See p. 25.

p. 38.

Prussia.

pp. 144, 145.

In Prussia, on the other hand, the examinations are conducted by a distinct body of Examiners, but the questions are principally drawn up by the Instructors in the various studies; these are selected, out of a considerable number, by the Examination Board, and given, with any additional ones which may appear desirable, to the Students: and the replies, which are all written, are, in the first instance, passed to the Instructor, who is required to examine them, to mark all faults and mistakes, and to give what is termed the first "*censure*." The papers are then handed to that Member of the Examining Board who is charged to report on the particular subject of Examination, who approves of the "*censure*" already awarded by the Instructor, or gives one of his own, which is final.

Austria.

p. 175.

In Austria, the examinations are entirely in the hands of the Professors belonging to the various Schools, and thus, in the three Great Military Countries, the examinations are conducted:—

1. In Prussia, by separate Examiners, with the aid of the Professors.
2. In Austria, by the Professors alone.
3. In France conjointly, but not concurrently, by Professors and Examiners.

We have attentively considered the effect, both on the Professors and Pupils, of the preceding systems of Examination; and while we are not at all disposed to recommend that the examinations shall still continue to be entirely conducted by the Professors and Masters belonging to the Royal Military Academy, in accordance with the *general* practice hitherto followed, we still think that it would be disadvantageous entirely to disconnect them from these examinations.

Accordingly we recommend:—

(1.) That examinations should take place at the end of each half-year or term.

(2.) That the examinations occurring at the end of the first four half-years or terms of a Cadet's residence, should be conducted by the Professor or Master who has taught the class in which he is placed, conjointly with another Master who has had no connexion with it.

(3.) That $7\frac{1}{2}$ per cent. of the marks obtained by the Cadets at each of the four first examinations, should be carried on and added to the marks they may gain at their final examination at the end of the fifth term. This will give a total amount of 30 per cent. on the marks awarded at the subordinate examinations, and the object in view is to induce the Cadets to apply themselves diligently to study from the moment of their admission.

(4.) That a separate body of Examiners (quite distinct from those appointed for the entrance examination) should be associated with the Professors and Instructors, for the final examination of each batch of Cadets whose period of residence in the Academy has expired.

(5.) That all the examinations should be conducted in the same manner, and on the same principles, as we have already fully detailed for the Entrance Examinations. WOOLWICH ACADEMY.

Having particularized the subjects of study to be followed within the Academy, we must now turn to the question of their relative importance or weight.

In our proposal for the Entrance Examinations we have stipulated for at least such an amount of mathematical knowledge as will allow the Cadet to become a good practical Artillerist or Engineer, and in the scheme of subsequent instruction have devoted to that study such a number of hours weekly as will admit of his becoming a scientific one; but it appears in evidence from different Officers that the study of the modern languages has hitherto been much neglected, and that very inadequate attention is given to drawing. Thus Sir R. Dacres, R.A., observes:—"The only suggestion I can make from my "experience in the Crimea is, that the knowledge of languages has not suffi- "cient credit given to it in the examinations, and I feel confident that if more "encouragement was given to this important branch of study, English Officers "would be better linguists, and the service be materially benefited." We propose, therefore, to augment the weights allowed to these subjects, and we have also sensibly altered those attached to some of the most important branches of study, as it would not be difficult to show that these have hitherto been fixed on somewhat undefined principles. p. 327 p. 297.

The exact nature of our scheme will be more thoroughly understood by referring to the following Table, in which the relative weights or influence and the amount of hours assigned weekly to the various studies, during each term, are fully detailed; but we have forborne to enter into the routine of the studies for each day in the week, regarding that as a detail that can be best arranged by the Authorities belonging to the Academy. Distribution of studies and their relative weights or importance.

Subjects of Study.	Weight or Influence of the various Subjects.	Number of Hours allotted Weekly to each Subject in each Half-year or Term.				
		Terms.				
		1st.	2nd.	3rd.	4th.	5th.
Mathematics, Pure and Mixed	20	16	12	6	2	2
German	6	3	3	3	2	2
French	9	5	5	5	2	2
Plan Drawing	6	6	4	2	—	—
Geometrical Drawing	6	6	4	2	—	—
Landscape Drawing	6	4	4	4	—	—
Architectural and Machine Drawing	2	—	—	4	—	—
Descriptive Geometry	6	8	4	—	—	—
Fortification	15	—	10	16	2	2
Military History and Physical Geography	2	—	2	2	—	—
Lectures on Natural Philosophy	3	—	—	2	2	2
Chemical Lectures	1	—	—	2	—	—
Course of Applied Chemistry	2	—	—	—	2	2
Analytical Chemistry	2	—	—	—	2	2
Practical Artillery	15	—	—	—	15	15
Tactics of the Three Arms	3	—	—	—	3	3
Practical Mechanics, Machinery, and Metallurgy	2	—	—	—	2	2
Surveying and Fieldworks	12	—	—	—	12	12
Lecture, on Geology and Mineralogy	2	—	—	—	2	2
Total	120	48	48	48	48	48

We assume that vacations to the amount of three months annually will continue to be allowed; that the examinations at the end of each half year will occupy about three weeks; and that with these deductions there will still remain about 100 days, including the half holidays on Saturday, during each half year, that may be solely given to study. Vacations.

6. *Period when the Selection of the Service should be made.*

Education in common, and period when the selection of the service should be made.

In the whole scheme of instruction we have been referring to, it is assumed that the knowledge to be acquired during the two and a half years of residence is necessary for the Officers of both Corps; and the points to be decided are, whether we have been right in acting on this assumption, and, if so, at what time the selection or choice of the service should be made.

We shall approach this subject by (1) endeavouring to ascertain the effect of the former practice, which deferred the *selection of the service until the conclusion of the course of instruction* at the Royal Military Academy; and (2) by examining the evidence on the subject as to the proper time for the selection being made.

(1) Whatever may have been the demerits of Woolwich Academy, and whatever weak points there may be in its system or mode of working, it is impossible to admit, in the face of the evidence we have received, that it has failed in supplying excellent Officers, although the fact that the choice of their Corps has usually been given to the Cadets at the head of each batch has given rise to some complaints.

Thus Sir Hew Ross observes:—

Sir H. Ross's testimony to the conduct, ability, and zeal of the Artillery Officers

p. 320.

"Of one thing I can speak with confidence, that during the period that I "have held the office of Adjutant-General, the Officers received into the Artillery "from the Academy have generally, by their conduct, ability, and zeal in the "performance of their duty, given the promise of high character and of talent in "their profession, and that the manner in which the various duties of the "Officers of the Regiment have been performed, and more especially since the "breaking out of the late war, has proved their energy, ability, and soldier-like "spirit. I may also remark, that whilst there has been a tendency to detract "from the merits and scientific attainments of the Officers of Artillery, there "never have been wanting, during my knowledge of the Regiment, men suited "to the occasion.

"I am borne out in this assertion by a reference to the Officers who have held "command in the field, and other responsible positions incidental to the war, "and by the evidence of those Officers who have been suddenly called upon "to fill the different situations as Heads of Departments, and who, under great "pressure, by aid of the large means at their disposal, have succeeded in "effecting improvements in mechanical and other sciences connected with their "professions in the different Departments, the want of which had long been "recognized by their less fortunate Predecessors, whom an unwise economy "had deprived of the means to carry them out.

and in favour of the Royal Military Academy.

"Thus much I have said to show that the Education at the Academy "(though I do not pretend to enter into the details of it) has not failed to "produce good fruits; and with such modifications as mature consideration may "suggest, it appears to me difficult to imagine an Establishment more competent "to its object."

And nothing can be stronger or more explicit than the following extract from Lieutenant-Colonel Claremont's letter to Lord Panmure:—"I must add that "all French Officers to whom I have spoken on the subject admit that what-"ever may be our system of Education, our Artillery Officers have proved "themselves all through the war as most highly efficient, and thoroughly "acquainted with every branch of their profession; in fact, they cannot praise "them too much."

Vide p. 358.

Similar testimony from French Officers.

Whilst with reference to the Engineers,

p. 347.

Sir J. Burgoyne observes that "If the object of the inquiry is founded on the "assumption that there is at this particular time a great necessity for radical "changes, because the Officers of the Corps have been found generally unequal "to their duties, in consequence of defective education, I cannot admit it."

(2) It has been recently suggested that the selection of the Service into which the Cadets wished to enter should be made immediately after the competitive entrance examinations, and be partly contingent on them. This practice would nearly accord with that followed in the Prussian, but be opposed to that adopted in the French service.

There is very little difference of opinion stated in the evidence with regard to the nature of the instruction to be afforded to the young Artillerist or Engineer.

It is true that Lieutenant-Colonel Gardner, R.A., questions—"Whether the "mathematical course does not contain much matter useful to the Engineer "but unnecessary for the Artillery, Officer, who again might be profited by "having his attention more directed to Artillery as a science." Again, he says, "It is also a question whether the Fortification course is not carried to an "unnecessary length for men destined to be with Artillery;" and it is possible that we might be disposed to agree with him as regards a more limited course in Mathematics, being all that is necessary for the effectual training of the large mass of thoroughly practical Artillery Officers; but we cannot recommend a change in the instruction on this subject to be made, in opposition to the general opinion of Artillery Officers, not only in England, but also on the Continent; the more particularly as we know full well that high mathematical attainments are absolutely required to enable the science of Artillery in all its branches to be fully developed. Again, for the reasons which are fully set forth in the evidence, we do not think that to enable the Engineer to perform the duties which are allotted to his branch of the service, he can have too intimate a knowledge of the effect and powers of modern Artillery.

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p. 337.

pp. 338, 349, 357, 365.

Major General Chesney, R.A., writing on this subject, says:—"The sug- "gestion that a competitive examination should determine, *in limine*, to which "branch of the service the Cadet is ultimately to belong, does not, at first "sight, seem to be objectionable. It might even be attended with certain "advantages, since the studies of the individual would take a special direction "on the termination of the period of probation. But if we are correct in "believing that a centralization of studies would be as beneficial as a separa- "tion is inimical to the interests of our service, any additional knowledge in "either branch in consequence of its being separately pursued must be at the "expense of that harmony and mutual good understanding which seldom fail "to be the result of constant intercourse while receiving instruction together in "early life."

Major General Sabine, R.A., says:—"I do not think that the question of "whether a man will make a better Engineer or Artillery Officer depends "upon a knowledge of Mathematics or of any other science, such as, for "example, Chemistry, or (as the strongest point) Mathematics applied to "Mechanical Constructions. He cannot be an *accomplished* Officer in either "branch without possessing such knowledge; but which branch a Cadet is "most qualified for depends much more, in my opinion, upon the *bent of his "mind*. The later, therefore, the period in which the choice is made, whether "the choice be made by others for him or by himself, the better. It must be "made, however, before education is finally completed, because there are "special studies for each branch, which up to a certain point may be carried on "in common, but must finally be perfected after the choice is made."

Lieut.-Colonel Simmons, writing on the same subject, says:—"The point of "separation of the young Officers, and distribution to the two corps, might "probably, with advantage to both, be at the period of their completion of the "practical course of Artillery."

Period for the selection of the service.
p. 357.

It may naturally be asked, what is the practice followed by young men who enter our Universities for the purpose of obtaining that knowledge by which they will be enabled to compete for honours, secure their degree, and ultimately derive certain advantages and facilities towards advancement in the Profession they may choose to adopt? Are they required to declare on entering the Universities that they are candidates for the Church, the Bar, the Medical or Legal Profession? Certainly not. The studies at the Universities are properly regarded as preparatory to those special ones which must be entered on, when they have chosen their future profession; and as their observation is extended, the bent of their mind becomes more and more developed, and they are enabled to scan closely the nature of the profession they wish to enter before they finally make up their mind to do so.

Practice at the Universities.

Why should not an equal liberty of choice be accorded to the Cadet? Why not give him to the last moment and allow him to trace out, as far as he can do so, the natures of the two services, before you oblige him to decide on one or the other?

Coinciding in the opinions of the large majority of the Officers who have favoured us with replies, many of which have already been quoted, we consider that it is far more desirable to extend the limits of the education in common to

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the Artillery and Engineers, than to contract them; and we conclude that the period at which the separation of the studies of those intended for the Artillery or Engineers should take place, is when they are about to quit this course of instruction for their more practical training as Officers of Artillery and Engineers at Woolwich and Chatham.

Accordingly, we recommend that immediately *prior* to their final examination at the Academy each Cadet should deliver in a sealed paper to the Inspector, in which he will state the Corps which he desires to join; and these papers should be kept unopened and forwarded to the Educational Board at the War Department, with all the details relating to the examination; and the claim of each Cadet for the liberty of choice will be considered and decided upon by the Secretary of State for War as soon as the classified list, arranged in order of merit, is made out from the results furnished by the final examination.

After passing the final examination at the end of the $2\frac{1}{2}$ years, we are of opinion that the Cadets should respectively be commissioned in the Artillery and Engineers; and

Increase of Pay to be given to the two senior Student Officers in each Corps.

To stimulate the Cadets to exert themselves in the Academy, and to continue that stimulus for a certain time after the young Officers are permanently commissioned in each corps, we would recommend that *the senior Student-Officer in order of merit in each Corps* belonging to *each promotion* should receive an increase of pay of the value of 60*l.* per annum, to be held for five years, and the *second on the list of merit in each Corps* should receive a similar increase to the extent of 40*l.* per annum for the same time; and that their names should appear in the Army List, with this distinction attached

Service to reckon from date of admission.

On the same grounds, we recommend that the service of Officers should count from the date of their admission into the Royal Military Academy.

7. *Discipline, Additional Buildings, &c.*

Causes which have affected discipline. p. 411.

On this important subject, it is almost sufficient to call particular attention to the excellent observations contained in Captain Shakespear's, R.A., letter, from which extracts are annexed:—

"I beg to say that I am not aware of any difficulty having taken place since "the period I assumed the command (early in July 1854) in the removal of "offenders from this Institution; but discipline was much affected in two instances "I may mention, where two young gentlemen were removed for bullying, one in "July 1854, and the other in February 1855. Both these gentlemen having "obtained commissions in the Line very shortly after their removal, and which "led the Cadets to conceive most erroneous ideas, 'that it required only to be "removed to get a commission without further 'trouble.' I am aware that "this was openly spoken of amongst them, and it led to much irregularity last "year; however, since the time I have mentioned, others have been removed, "and have, I believe, failed in obtaining commissions. The result has been "favourable to the Academy in the matter of discipline.

Suggestion that when a Cadet is removed, that step should be final.

"Discipline is further affected by the continued attempts made by the friends "of those removed for misconduct, in endeavouring to get a Cadet re-instated; "this may be very natural, but is detrimental to good behaviour amongst the "Cadets generally. Upon this subject I would suggest that when, after due "and careful consideration before a Court of Inquiry, or otherwise, it is con-"sidered necessary for the well-being of the Institution, to remove a Cadet for "misconduct, that the friends should be made acquainted, and that he should "then be removed, that this step should be final, and a report made to the "Commander-in-chief for any future reference.

"I would add here, that I am very averse to the punishment of removal if it "can possibly be avoided. I have seen, in some instances, the good effect of "rustication, though this entails much expense on the friends, but not so great "as in removal.

Certain punishments injurious to discipline.

"There are punishments inflicted which are detrimental to a sound state of "discipline, and on which I request to offer a few words. The regulation of "punishing Corporals and Cadets for 'bad returns,' at the close of each month, "is one; and long confinement to the inclosure is another. Although the first-"mentioned is in consequence of inattention or idleness in study, yet the Com-"manding Officer is responsible that the punishment is carried out.

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"There are generally from twenty-five to forty Cadets punished for 'bad "'returns' on the last day of the month. I have constantly remarked the evil "effects of this system of dealing with the young gentlemen; it is a kind of "worrying punishment, which may not take place for several days after the "irregularity or idleness has happened; the moral effect is consequently lost: "so many being punished together, and turning out to extra drill together, "begets carelessness amongst them. It is well known in the Military Branch "that the general conduct is affected by these monthly returns, and I believe "the punishment does not carry much weight with it.

Long confinement injurious to discipline.

"The object of punishing young lads ought to be well considered; it can do "much good, and, at the same time, can do harm, if no moral effect is produced.

"Regarding long periods of confinement to inclosure, they are detrimental to "discipline. Cadets get tired with several days' extra drill and confinement, "and one evil of such punishment is, that before it is over, a Cadet may again "be in arrest or confinement for some other irregularity in or out of study, and "this makes him careless, when he perhaps finds himself undergoing two or "three punishments at the same time.

Punishments should be short, prompt, and decisive.

"I would suggest that the punishments should always be short, prompt, and "decisive, and given immediately after the irregularity has been committed "(excepting cases requiring a Court of Inquiry, or a special Report), and that "they should consist of the same kind as at present in force; but for idleness "in study, task-work should be added to a short punishment, and that there "be no punishments at the end of a month for 'bad or indifferent returns.'

Additional building required. Chapel, roof for the gymnasium, and covered building for drill.

"There are other subjects that would be beneficial to discipline, if carried "out, viz., the want of a chapel has been very much felt for years past, there "being no place for Divine worship except the dining hall. I think discipline "would improve were there a proper building for religious worship.

"A roof for the Gymnasium, and a larger workshop for all the Cadets: also "a place covered in at the west end, where the Cadets' garden is, for gun-drill, "&c., in wet weather would be of much service to the institution.

"I may say that whatever can be added for the benefit and comfort of Cadets "is sure to be beneficial to discipline, because it gives them employment, and "therefore tends to make them happy and contented. A little money should "not be grudged for so desirable an end."

Bearing these recommendations in mind, and taking into consideration the more advanced age at which it is now proposed to admit Cadets, we are of opinion, and have drawn up our scheme in accordance therewith, that the hours of study may be increased by one hour daily throughout the year, and a portion of the drill, exercises and shiftings, &c., which have hitherto formed part of the employment of the year devoted to the practical class, may now be undertaken at an earlier stage. But in order to do this with convenience and without loss of time, additional facilities are required to be provided at the Royal Military Academy.

Covered building for drill in wet weather.

Thus, there should be a covered building in which the ordinary drill of small squads, and the various kinds of Artillery gun drill might be carried on during wet weather, as at Metz; and a small portion of ground should be artificially prepared immediately contiguous to the Academy, probably on the common behind it, where the removal and shifting of heavy guns and carriages up and down steep slopes might be practised and carried on.

Covered building required for sand modelling.

For similar reasons we consider that the erection of a covered building, similar to that in use at Addiscombe, in which the modelling in sand of small portions of fortifications, intrenchments, &c. can be at all times carried on, would be of great advantage to the Professor, in affording instruction in that branch of study.

Chapel required.

It is also highly desirable that a Chapel should be erected.

Gymnasium to be covered over.

We should also advocate the covering in of the now open gymnasium which we are given to understand has not been entertained on account of the expense.

Separate sleeping-rooms for the cadets.

We are also of opinion that, supposing the instruction of the candidates for the Royal Artillery and Royal Engineers should continue to be given at Woolwich Academy, and that those of a riper age only are in future to be admitted, provision should be made for accommodating the whole with small separate sleeping chambers, by the erection of additional buildings, or alterations in the existing ones.

Riding, drill, gymnastic exercises, &c.

Lastly, we should strongly urge the necessity of the Cadet being taught to ride by one or more lessons weekly, and that they should be well-trained in the Infantry and Artillery drills, and practised in gymnastic exercises, swimming, rowing, and the various kinds of fencing.

Number of commissions to be given annually.

Assuming that the course of instruction which we recommend can be successfully carried into operation in a course of two and a half years' duration, and that in the present state of the two corps fifty commissions in the Artillery and Engineers can be advantageously bestowed during the course of each year, by two half-yearly promotions of twenty-five Cadets, the number required to be resident in the Academy, in order to provide for this number of commissions, would amount to 125, and allowing for casualties and a few partial failures, that number should probably be augmented to 135. This would require a half-yearly admission of about twenty-seven candidates.

Number required to be admitted every half-year.

Importance of not filling up existing vacancies too rapidly.

It is of very great importance that the vacancies in the Artillery and Engineers now existing should not be too rapidly filled up. In all Corps in which the promotion is solely by seniority, unless the retirements, optional or obligatory, are carried out on a very extensive scale, the promotion must necessarily meet with great checks; and but for the augmentations which have taken place in the Artillery and Engineers since the year 1820, the promotion in those services would have been lamentably slow. As regards the Junior Officers of both Corps of about ten years' service, the promotion has been unusually rapid, but it is quite certain that this must eventually be compensated for by slowness of promotion in other ranks, unless further augmentations continue to take effect, which is scarcely to be expected during a state of peace; and hence it is very desirable to spread over a considerable number of years the introduction of young Officers into the two Corps, to fill up the existing vacancies, and to supply *the yearly* casualties.

We beg, in conclusion, to recommend a slight alteration in the existing arrangements with regard to the appointment of the Governor and Inspector of Studies.

For many years past the Lieutenant-Governor and the Inspector of Studies have belonged to the same Corps; in our opinion this practice should not be continued, and we therefore recommend that:—

Appointments of Governor and Inspector to be held alternately by the Artillery and Engineers for periods of five years.

1. The Governor or Lieutenant-Governor of the Royal Military Academy should be a Regimental Field Officer of the Artillery or Engineers; the appointment to be held alternately by the Artillery and Engineers, for periods of five years.

2. The Inspector of Studies should be a Regimental Field Officer or Captain of Artillery or Engineers, and of a different Arm of the service to the Governor or Lieutenant-Governor, but we think that inconvenience would result from changing both at the same time, and would therefore recommend that an interval of one term or six months should intervene.

pp. 12, 33, 134.

These recommendations are entirely in accordance with the practice adopted both in France and Prussia.

Recapitulation of the principal Recommendations.

1. The Royal Military Academy for the instruction of Cadets for the Artillery and Engineers to be reorganized.

2. The entrance to this Institution to be by means of competitive examinations held every six months, care being taken to inquire into the previous conduct of the candidates.

3. The ages for admission to be between sixteen and nineteen.

4. The Examiners for admission to be entirely independent of the Royal Military Academy, and to be appointed by the Secretary of State for War.

5. The subjects absolutely required for the entrance examinations to be—

	Marks.	Marks.
Pure Mathematics - - -	2,000	3,500
Mixed „ - - -	1,500	
English Language, Literature and History,	1,000	1,750
„ and General Geography -	750	
French - - - - -	1,000	1,000
Drawing - - - -	1,000	1,000
		7,250

And optionally two out of the four following subjects:—

Latin - - - - -	1,000
Greek - - - - -	1,000
German - - - - -	750
Experimental Sciences - - -	1,000

6. Two Examiners to be appointed for Mathematics.
Two for the English Language, Literature and History, and General Geography.
Two for the Classics.
One for the Experimental Sciences.
Two for French and German.
Two for Drawing.

7. The entrance examinations to take place sufficiently in advance of the day on which the half-year's course of instruction at the Royal Military Academy commences, to enable the successful candidates to be present.

8. To encourage emulation, and to induce the candidates to come up well prepared, provision should be made in the Army Estimates for granting to the two who stand first in the classified list of merit at each entrance examination, Free Places in the Royal Military Academy; and the two next should only pay half the contribution which would otherwise be required from them.

9. The duration of the course to be two and a half years.

10. A Board of Improvement for the Royal Military Academy to be established, consisting of—
The Governor.
The Inspector of Studies.
The Officer commanding the Cadet Company.
The Professor of Mathematics.
" Fortification.
The Instructors in Practical Artillery and Surveying.
An Officer of Artillery
" Engineers } appointed by the Secretary of State for War.

11. The number of Mathematical Masters to be diminished by two.

12. The appointment of an Instructor to teach Military History in connexion with Physical Geography and the Tactics of the Three Arms.

13. A Lecturer in Natural Philosophy should be appointed.

14. That the Final Examination be conjointly conducted by Professors of the Establishment, and by Examiners appointed for the purpose by the Secretary of State for War. The latter to be:—
One in Mathematics.
One in Fortification, Military History, and Tactics.
One in French and German.
One in Practical Artillery.
One in Surveying and Field Works.

15. A covered building, in which drill, &c. can be practised during wet weather to be erected.

16. A covered building in which sand modelling can be carried on to be built.

17. A chapel to be erected.

18. The Cadets to have separate sleeping-rooms.

19. The appointments of Governor and Inspector to be held alternately for periods of five years by Officers of Artillery and Engineers, but both appointments should not continue to be held by Officers belonging to the same Arm of the Service.

MILITARY EDUCATION, ENGLAND.

V.—ROYAL ARTILLERY.

Having fully discussed the subject of the professional education of the Cadet prior to his being actually commissioned, we must now direct our attention to the question of what further professional instruction should be given immediately on his joining his corps at Woolwich or Chatham.

The practical course to be then pursued at Woolwich would naturally, in some respects, form a parallel to the course suggested for the young Engineer Officers at Chatham. We shall do little more in describing this than state the opinions of Artillery Officers on the subject, drawing attention to some points of practice in Foreign Military Systems.

I. We shall describe (as it existed prior to the war) the instruction afforded to young Officers immediately they were commissioned, quoting sundry observations and opinions of Artillery Officers on the subject.

II. We shall advert to the propriety of affording instruction to Officers of some standing in the service, and of thus constituting, as it were, a species of Senior Department for the Royal Artillery.

III. We shall offer a few suggestions tending to improve the efficiency of the Artillery Service.

I. *Instruction afforded to young Officers.*

Professional instruction afforded to young Officers of Artillery. p. 320.

The course of professional instruction for the young Officer of the Artillery is thus described by Sir Hew Ross:—"At the period of the breaking out "of the war, the young Officers on being appointed to Commissions in the "Artillery from the Academy, joined at Woolwich, and were placed under a "Director of Studies, whose duty it was to superintend and assist them in their "professional pursuits. For this purpose a class-room had been provided in "the Royal Artillery Institution, where for the first six weeks the Director had "the entire control of their time and instruction to enable him to obtain such "knowledge of their disposition, abilities, and attainments, as would aid him "in the further direction of their studies. They were then permitted to enter "upon the usual company duties, and also, at stated times, to attend parades, "artillery practice, riding schools, and those drills and exercises which were "requisite to the due performance of their duties as Officers; and which could "be performed without trenching on the hours of study.

Subjects of study.

"The studies comprised a course of reading and examination in military law "(Court Martial and Mutiny Act); military history, British and Foreign; "treatises on Artillery; treatises on fortification; reconnoitering and out-post "duty; field sketching and use of instruments; military bridging; application "of the three arms; strategy, battles, and sieges; chemistry; mineralogy; "military topography; military biography.

"This plan came into operation in 1850. The first Director of Artillery "studies having been sanctioned provisionally by Lord Anglesey, as an experi- "ment, in the spring of that year. He had the disadvantages to contend with "of limited means and of restricted accommodation allotted to his class in the "barracks; but his success was so evident that I was enabled before the close "of the year to recommend that his appointment should be confirmed, with a "suitable position and salary, which was accordingly done.

Power granted to visit foreign arsenals and fortresses.

"In April 1853, there was an extention of the means of instruction by a "grant from the Treasury of 400*l.* per annum, on the recommendation of Lord "Raglan, to enable a proportion of the most intelligent of the young Officers "under the Director of Studies, to visit the arsenals and fortresses on the Con- "tinent, and the manufacturing districts at home, and to obtain the advantage "of French and German masters, who were, in addition, to afford instruc- "tion to Officers of Artillery of all ranks who might be desirous of profiting "by it.

"In September 1853, the new Royal Artillery Institution was opened, in- "cluding the excellent class-room already referred to for the class of young "Officers, with a laboratory, drawing room, &c. for the general use of the "Officers.

ROYAL ARTILLERY.

"The liberality with which the requirements for the instruction of the young "Officers had been met, and the success which had attended the labours of the "successive Directors of Studies, seemed to leave little to be desired, when the "necessities of the service in 1854, calling for the immediate active employ "ment, at home or abroad, of all the junior Officers of Artillery, rendered it "necessary to suspend the course of instruction.

Secretary to the Royal Artillery Institution.

"The appointment of a Secretary to the Royal Artillery Institution in 1853, "shortly before the commencement of the war, would have proved, and must "hereafter prove, a most useful auxiliary, as affording the means of reference "and advice to such Officers as might be desirous of pursuing at the Institution, "and at the out-stations, the particular subjects which might engage their "interest and attention."

Duration of course. p. 343.

Captain Younghusband states that—"The whole period which each batch "remained under the Director of Studies was six months, after which each "Officer joined his company on home or foreign service.

"This system was broken through at the commencement of the war, on "account of the demand for Officers, and for an interval of about twelve "months the office of Director of Studies was vacant. It was re-established "in July 1855, with a Staff on a much more extended scale than heretofore.

Staff of Instructors.

"Under the Director of Artillery Studies there are now—

"Two Captains of Artillery as First and Second Instructors in Military "Exercises.

"The French and German masters (as heretofore, but giving a longer "attendance).

"An Instructor for Surveying.

"An Instructor for Military Drawing, &c.

"A Lecturer on Natural Philosophy and Mechanics."

Up to April 1856, none of the young Officers who had passed lately through the Academy have benefited by this augmentation of the Educational Staff.

Reasons for introducing this system of instruction. p. 320.

Sir H. Ross's explanation of the grounds on which this instruction was commenced is as follows:—"I was led to submit a proposal to Lord Anglesey for "introducing this system, from a sense of the benefit to be derived from a "closer supervision than formerly of the young Officers of Artillery joining at "Woolwich from the Academy; the importance of such a measure having been "increased by the enlarged temptations to idleness within the reach of the "young Officers since the opening of the railway from Woolwich to London."

Opinions as to this instruction, and the period when it should be given.

It will be seen that the opinions of Artillery Officers are somewhat divided, not only as regards the propriety of such instruction being supplied, but also with reference to the period when it should be given.

Sir H. Douglas very much in favour of it. p. 314.

Sir Howard Douglas expresses himself very decidedly in favour of such a system:—"Further instruction would be possible and desirable; it is even "necessary, if the school education at Woolwich is to be rendered available, "as far as it might be, for the public service. Most young men, after joining "the regiment or corps, neglect to keep up the knowledge they have acquired "at the Academy, and thus are incapable of applying it to useful purposes. "Officers of Artillery and Engineers who have distinguished themselves in the "scientific world are bright exceptions.

"Officers of both branches require a greater amount of mathematics than "can be communicated to them during their cadetship. Supposing them to "retain all the elementary mathematics which they have acquired then, they "need the higher branches of dynamics and hydrodynamics, the knowledge of "tactics, with military history, and a more perfect knowledge of the French "and German languages. These subjects might be acquired at Woolwich "under professors and masters. More practical knowledge is required respect-"ing the strength of materials and the construction of machinery. Artillery "Officers require a more complete knowledge of chemistry, the tactics of Artil-"lery in the field, &c. These subjects would require professors and instructors, "and might be obtained at the Academy, at the Arsenal, and in the Dock-"yard."

Major-General Chesney's opinion

Major-General Chesney is also in favour of giving instruction to the young Officer when he joins his Regiment, thus:—

in favour of continuation of study during the temporary commission of Officers. p. 326.

" An extension of the time employed under the superintendent of studies " is not only desirable, but absolutely necessary. If, without appearing to go " too far, we may consider the instruction already received in the Royal Mili- " tary Academy to be the foundation of a good education rather than education " itself, it follows that the previous course of study should not only be followed " up, but should be a good deal enlarged during the probationary appoint- " ments; while, at the same time, due attention should be paid to the important " objects of drill and practical acquirements at large.

" It seems all but impossible that any Officer, however great his talents and " acquirements may be, could fulfil the task with which Lieutenant-Colonel " Wilford is intrusted. Indeed, it is clear that assistance, and this to a very " considerable extent, is indispensably necessary for the instruction of young " Officers, if it be intended to qualify them, both theoretically and practically, " to do honour to their profession. It is evident that to arrive at the effective " use of the various missiles, as well as of the powerful engines connected with " artillery, a greater amount of scientific knowledge is required than our Officers " have as yet brought to bear on this branch of the art of war."

Col. Wilford points out the difficulties of carrying on such instruction, but thinks beneficial results may be obtained from it. p. 331.

Colonel Wilford in adverting to the subject alludes to the possibility of ob- " taining useful results:—" The interruptions of military duty make it difficult " to enforce any regular and compulsory courses of study upon young Officers " after their first joining to do duty at Woolwich.

" Nevertheless, by acting in concert with the Major-General the Command- " ant, who is also the Commanding Officer of the Royal Artillery, much that " is useful might be accomplished.

" Young Officers might, under the superintendence of the Director of Artil- " lery Studies, be required to pursue the study of military sketching and " reconnoitring; to take up the study of the French or German languages, " they might receive instruction in military law, military finance, military " history, and the art of war.

" It is believed, that if brought officially into connexion with the Director of " Artillery Studies, he might, in some sort, direct and guide the choice of books " and professional reading of the young Officers; direct their attention to proper " objects in the manufacturing departments of the Royal Arsenal; and, gene- " rally, might in many instances, exercise a beneficial influence on their minds. " It must, however, be observed, that these objects must be effected in subor- " dination to the calls of military duty, which, under any regulation that could " be divised, would more or less interrupt regular application."

Lieut.-Colonel Gardner advocates this instruction being given. p. 335.

Lieutenant-Colonel Gardner says:—" The great demand for Officers having " ceased, it is possible and very desirable that further instruction and assist- " ance should be given to Officers on joining. If the young Officer has " previously passed through the Academy, then nine months or a year of " special instruction might suffice, during the last three months of which he " should be attached to a battery.

" Should the young Officer join direct, after a public competitive examina- " tion, then a longer time under special instruction will be necessary."

Col. St. George thinks further theoretical study not desirable. p. 328.

Colonel St. George, on the other hand, does not appear to coincide in opinion with those who are in favour of continuing to afford facilities for prosecuting theoretical studies, but alludes to the necessity of creating a stimulus for future exertion thus:—" I can make no suggestions with the view of the " improvement of the teaching now given at the Academy at Woolwich. " The boy learns enough; all that is necessary is to prevent the man forgetting " it." And again, " With the amount of information an Officer must possess on " joining the Regiment, together with the facilities that exist of increasing " it unaided, farther assistance in the prosecution of theoretical study is not, " I think, desirable. What is desirable is a motive to stimulate him to " exertion.

" The whole time of an Artillery Officer in peace should be spent in gaining " and imparting professional information. An organized system of instruction " should be inherent in the constitution of the regiment—not in name, but " in fact. Commanding Officers, at all stations, should call daily upon those " below them for reports, surveys, sketches, plans, reconnaissances, and all " the varied duties of their profession; and all appointments, advantages, and " rewards should be given alone to such as perform these duties best."

Colonel Barker, in speaking of this instruction, bears testimony to its utility, but considers that it would be more efficacious if given at a later period:—"There "is no doubt that much benefit was derived from it, but I think still greater "results would have been obtained had the Officers, after leaving the Academy, "performed their regular duty with the regiment for at least one year before "commencing this course of study, to which they would then, after such relax-"ation, have devoted themselves with more earnestness."

Col. Barker's evidence. p. 334.

Captain Younghusband observes:—"The period at which an Officer first "joins the corps from the Academy, where he has been subjected to strict "discipline and a very laborious course of studies, comprising a great variety "of subjects, is not favourable for requiring of him a continuance of study. "There are many essential points of his profession to be learnt; but, on the "whole, he is ill-inclined to give his mind earnestly to it. A civilian entering "for the first time upon military life finds so many things of novelty and interest "that he is more inclined to set to work to learn the duties of his profession; "but in both cases some practical experience, by the individual himself, of his "own deficiencies, is of immense service. It would be a great advantage to "allow him to enter upon his military duties for a certain period, say about "three years, and then, after he has discovered his own defects, give him the "opportunity for study."

The period after joining from the academy is very unfavourable for study, which should be taken up at a later period. p. 344.

From the nature of the service, which we have before alluded to, we cannot but think that the young Artillery Officer would be most advantageously employed in obtaining practical field instruction with the men of the Company to which he is attached, immediately he is commissioned, in addition to a continued attendance on Artillery practice, not limited merely to the determination of the range of fire, but including its effects under particular circumstances; for the purpose of acquiring a thorough knowledge of the powers of different kinds of projectiles. We should recommend exactly a similar routine for the young Engineer Officer, if his immediate duties were solely those of a Military Engineer employed exclusively in connexion with his men, but as his duties are not limited to this sole object, further instructions in certain special theoretical studies, not hitherto taught at the Royal Military Academy, nor included in our Scheme of Instruction, is absolutely necessary, before he has any chance of being competent to perform the ordinary routine of his duties.

Opinion in favour of the young Artillery Officer's practical instruction with his Company, as soon as he is commissioned.

II. *On the Necessity for a Species of Senior Department.*

There is a very general agreement of opinion among the Officers of Artillery as to the necessity for keeping up the Royal Artillery Institution, which was originally commenced by the "private exertions of some Officers of the "Corps; subsequently received considerable assistance from Government, but is "supported almost entirely by the voluntary subscriptions of its members, which "include nearly every Officer in the Corps, as the means of enabling a certain "number of Officers to go through a special course of study." Thus constituting a species of Senior Department for the Royal Artillery.

Expediency of keeping up the Artillery Institution at Woolwich.

Sir Hew Ross, it will be observed, considers, "That the Royal Artillery "Institution, with the powers of extension and correspondence through its "Secretary, and with a system of detached professional libraries, which could "easily be established at the out-stations would afford the means of carrying "on professional studies and improvement."

Sir H. Ross considers the Royal Artillery Institution can be made the means of carrying on professional studies.

Major-General Chesney thus expresses himself on this subject:—"Practical "Artillery of itself opens a very wide field for study, since success in this "branch would involve a knowledge of the casting, boring, and general use of "metals as applied to fire-arms in general; also an intimate acquaintance with "the science of fortification, the theory of projectiles, practical mechanics, and "natural philosophy, particularly with that branch comprising chemistry, which "on account of the manufacture of gunpowder as well as of the various prepa-"rations of the laboratory, is of the greatest importance.

Practical Artillery; pp. 321, 326.

"In addition to these, other subjects also claim the attention of the students "during the period of their probationary Commissions, such as modern lan-"guages; ancient, modern, and military history; statistics; military adminis-"tration and legislation; geography; topography; plan drawing; reconnoiter-"ing; castrametation; pontooning; and tactics in general.

and other studies.

Proposed assistance to the Superintendent of Studies.

"By giving professional and other assistance to a moderate extent, the "Superintendent of Studies would, I believe, be enabled to secure a superior "class of Officers without going quite to the extent of forming an establish-"ment similar to the Senior Department at Sandhurst. The fact that the "progress made during the time of probation is to determine the succession to "permanent Commissions, would of itself be a salutary incitement, and if it "should be decided that an examination is to precede the Officer's advance-"ment to a company, and again to a Lieutenant-Colonelcy, there is little doubt "that Officers would in after life devote part of their time to the improvement "of the mind."

Colonel Wilford recommends a limited class of Officers being freed from military duty for a period of 12 or 18 months. p. 331.

Colonel Wilford, lately Director of Artillery Studies, and now Governor of the Royal Military Academy, remarks:—"Witnessing as I do the daily diffi-"culty Officers encounter in their attempts to pursue voluntary courses of "study at the Royal Artillery Institution, I am of opinion that it would be a "great benefit to the Corps of Artillery if a limited class of Officers were with-"drawn from all Military duty for a fixed period, say 12 or 18 months, with a "view to their pursuing a regular course of study under competent instructors "at the Royal Artillery Institution. No Officer being eligible to enter the "class who had not done three or four years' military duty, or who could not "pass a satisfactory examination, showing that he possessed good talents and "had retained the theoretical acquirements he had attained at the Royal "Military Academy."

"The course to be partly special, that is, having an exclusive bearing on the "science of Artillery, and partly general, that is to say, qualifying the Officer "for general or Staff duties.

"Without entering further into details, it may be remarked that such a plan "would afford the Corps of Artillery a proportion of Officers of developed "talents and known scientific attainments, who would be available for any "duties that might be required, and who might be expected to contribute to "the improvement of Artillery science.

Col. St. George considers an institution similar to the Senior Department desirable. p. 328.

Colonel St. George considers that—"An institution, similar to the Senior "Department at Sandhurst, appears desirable; but as study must be looked "on as a means, and not an end, such institution would be useless in the Artillery "unless it were known to lead the student to some definite and tangible advan-"tage hereafter."

Colonel Barker is in favour of an institution similar to the Senior Department at Sandhurst. p. 334.

Colonel Barker suggests that "In order to assist Officers afterwards in ac-"quiring or keeping up information I would recommend an institution some-"what similar to the Senior Department at Sandhurst, the instruction afforded "being of course of a much higher order, and should include Chemistry and "Mineralogy, at least as far as they may be applicable to the manufacture of "guns and gunpowder."

Lieut.-Colonel Gardner's evidence. p. 335.

Lieutenant-Colonel Gardner observes that—"Such an institution is not only "desirable, but absolutely necessary, if the efficiency of the Artillery service "is aimed at.

"The institution should teach, first, to Officers of some standing, the "manufacturing duties of Artillery, whether for the departments at home, or "for the smaller, but not less important establishment, 'the parks' for repairs "of material in siege trains, and also in garrisons. The want of these esta-"blishments for repairs constitutes one great defect of the Artillery service. "Second, the special duties of Artillery as regards its application. Third "general staff duties.

Subjects that should be taught.

"First. Manufacture; mathematics and mechanics, with special reference to "artillery, chemistry, geology, mineralogy; geometrical drawing; French "and German; physical geography; strategy and tactics; the theory of forti-"fication and of attack; the steam engine.

"Practically.—Work in the departments.

"The Arsenal course might require about three years.

"Second. Artillery duties. (1.) In Garrison.—Mathematics limited as "compared with the above; fortification as above; drawing; modern languages, "colloquially and grammatically; military law and military history; physical "geography; tactics.

"Practically.—Gunnery and general service of heavy guns; construction of "platforms, blindages, expense magazines, &c., as laid down in the Repository "Course, including cover for guns.

" (2.) In the Field.—Mathematics limited; fortification as above; tactics; " modern languages as above; military law and history; surveying and recon- " naissance; veterinary science; physical geography. ROYAL ARTILLERY.

" Practically.—Gunnery, with field guns; drill, both special and associated; " harnessing, shoeing, and all that relates to the care of horses; riding and " driving; limited course in carriage department; construction and repair of " harness; construction of temporary bridges and pontooning.

" (3.) Artillery duties at a siege, a combination of the above.

" Third.—General Staff Duties.—Mathematics, including astronomy, sur- " veying, and reconnaissance; physical geography; military law and history; " geometrical and landscape drawing; modern languages as above; fortification " as above; strategy and tactics.

" Practically.—Drill with the three arms; riding, fencing, &c.; and the " duties, as far as they can be taught, of Adjutant-General, Quartermaster- " General, and Military Secretary."

And Captain Younghusband is equally explicit as to the advantages to be derived from such an establishment:— Capt. Younghusband is in favour of an institution similar in principle to the Senior Department at Sandhurst. p. 344.

" The advantage to the Artillery of an Institution similar in principle to the " senior department at Sandhurst cannot be over-estimated.

" It does not seem desirable at this time to enter into details respecting the " course of study which should be pursued at a senior department; it may, " however, be remarked that no Officer should be admitted who has not " actually performed at least three years actual regimental duty, and who " cannot prove, by examination, that the interval which has passed since he " joined the corps has not been misapplied. Periodical examinations should be " made of the Officers studying, and any one who does not make satisfactory " progress immediately sent back to the regiment. In fact, every care should " be taken that the time and opportunities given for study should be earnestly " devoted to it. On the other hand, the Officer should be relieved from all " regimental duty, and arrangements made which will not render him liable, " under any circumstances, to be sent back to his company."

The only trace we found abroad of any intention to give specific instruction to Officers of Artillery and Engineers at all analogous to a Senior Department, was in Austria, where it is intended to have an united Higher Course for young Officers belonging to those Arms, to come into operation very shortly after they obtain their first Commission, and to be limited to that portion of the Officers most capable of profiting by it. p. 178, 215.

If such Institutions be established in England, at Woolwich and Chatham, we can conceive that they might be made to work very advantageously for the improvement of Artillery and Engineering Science; but we should observe, at the same time, that the instruction provided by the Government should be restricted to the Sciences and Duties devolving on those Arms of the Service, and that it should not be made the medium for obtaining for them undue advantages over other branches of the Army. Opinion in favour of instruction being afforded to Officers of some standing; but restricted to their particular duties. p. 349.

Thus, if employment on the Staff of the Army is at any time to be made solely dependent on passing through a Staff College, or on passing an examination equivalent to that which is passed in that College, the Officers of any one branch of the Army that possess a larger amount of available time for study than the others, will undoubtedly be placed in a very advantageous position.

As far as regards the Engineer Service, it is certain from the evidence brought before us, that their duties are already sufficiently extensive to tax the whole of their energies. The Engineers have already sufficiently numerous duties.

It is, of course, desirable, as a direct encouragement to talent and energy, that the highest Commands and Appointments should be laid open to the Officers of the Special Arms, equally with those of the other branches of the Army, as is now the case in France. But the duties of the Staff of the Army in that country are there performed solely by a Special Staff Corps; the Staff duties of Officers of the Special Arms being limited to their own service. The Staff duties of the Army in France performed by a Staff Corps. p. 64.

III. *Suggestions with regard to the Employment of Artillery Officers.*

It appeared to us that one practice followed in France, as regards the Artillery, seems highly deserving of imitation in England. We allude to the detaching Officers of the rank of Second Captain from their Companies, Employment of Artillery Officers in the Manufacturing Departments; p. 39.

and sending them to the various Arsenals, Foundries, &c., in order that they may become *thoroughly* acquainted with the whole of the processes connected with the manufacture of Artillery and all kinds of Artillery *matériel:* and we submit, that it would be desirable, at all events, that a portion of the Officers of the Royal Artillery of some standing and considerable ability should have similar opportunities afforded to them.

Officers of Artillery and Engineers to be attached to the Embassies of the principal Military Nations of Europe. p. 332.

We have reason to believe also, that essential benefit would be derived to the public service, if an Officer of ability belonging to the Artillery or Engineers, were attached to the Embassies at the Courts of the principal Military Nations of Europe; for the purpose of observing and reporting to the Secretary of State for War, on the improvements introduced from time to time in the Art of War, Systems of Fortification, Manufacture of Material, or changes in the system of Military Education. We do not consider that these appointments should be held by individuals for a longer period than two years; they should be given to the most deserving Officers, who would thus be afforded additional means for improving their knowledge of Military Science and Modern Languages, and who should be called upon to make periodical reports to the Secretary of State for War.

Young Artillery Officers to be sent for 3 months to Chatham.

We beg to recommend that—

1. In addition to the Practical Field Instruction with the men of their Companies, as already alluded to, young Artillery Officers should be sent to the Royal Engineer Establishment, at Chatham, for three months, at the particular season of the year when the regular siege operations are being carried forward.

A limited number of Artillery Officers of five years service to do duty in the Arsenals, &c.

2. A limited number of Officers, of not less than five years service, should be employed in the various departments in the Arsenal and at the Artillery Manufacturing Establishments, so that they may have the opportunity of becoming practically and fully acquainted with the whole of the details of the manufacture of every kind of Artilery *matériel.* The selection should of course be made from amongst the most able, as determined by a competing examination; by the reports of their last examination at the Royal Military Academy; or by other well established proof of superior ability.

VI.—THE ROYAL ENGINEERS' ESTABLISHMENT AT CHATHAM.

We shall now direct our attention to the purely professional Instruction afforded to the young Engineer Officer when he is Commissioned and joins the Royal Engineer Establishment for Field Instruction at Chatham, and we propose to show:—

I. The nature of the instruction afforded.

II. The opinions of various Officers of the Corps, with regard to the necessity of a more extensive course of instruction being adopted.

III. The nature of the duties of the young Engineer, and the circumstances under which they are frequently performed.

IV. The system for training the Military Engineer in France, and a comparison of the Educational Staff devoted to such training at Metz and Chatham.

V. Deficiencies at Chatham, and suggestions as regards the alterations which appear to be required in the system for carrying on the instruction.

VI. Measures that should be adopted to induce the young Officers to take greater interest in their profession.

I. *Nature of the Instruction afforded to Young Officers.*

We have already mentioned the deficiencies in the scientific education of the young Engineer Officer, which are stated to exist when he joins at Chatham, and it will be seen that the only Instruction he afterwards receives, either in the purely Military or Civil branch of his profession, which is given immediately he obtains his Commission, is not in any way calculated to enable him to supply these deficiencies, however desirous he may be of doing so.

Course of Instruction.

The course of instruction, which usually occupies about fifteen months, is comprehended under the heads of,—

i. Field Duty.
ii. Scientific Instruction.

Field duties.

1. Under the first head are comprised some of those duties which are required of the Military Engineer in the field, such as sapping, mining, batteries of position, intrenchments, formation of military bridges for the passage of rivers by Artillery, Cavalry, and Infantry; the formation of stockades and their destruction by gunpowder: subaqueous explosions, escalading, telegraphing, the use of the voltaic battery and the diving bell.

Scientific instruction.

ii. Under the second head, the Officer, whilst employed upon the above duties, is also expected to devote a portion of his time to reading the best professional authors on Military Engineering, and, as a proof of his diligence, he is required from time to time to produce translations of the best examples of sieges, defences, extracts of mining operations, &c., accompanied with neatly drawn plans, illustrative of the operations detailed; after which he is required to prepare projects, founded on the above elementary course of study, of the—

Attack of Fortresses;
The demolition of Revetments, Bridges, &c;
The formation of Military Bridges; and
The repairs of Bridges which have been destroyed;

with memoirs on systems, and on the projects of other Officers or individuals, which may be deemed worthy of investigation; with such other exercises of a similar character as the Director of the Establishment may consider to be necessary. To these are added a course of practical Architecture, with a series of lectures on Civil Engineering, including the details of erecting and working a steam engine, which is practically explained on a small engine belonging to the Establishment, the whole of the working parts of which are taken to pieces and put together again by the Officer.

A small laboratory affords the means of practising such operations in analytical chemistry as are required of the Engineers, and it also enables an Officer to

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satisfy himself from actual investigation of the properties of the various building materials with which he may be working. Surveying, with Military Reconnoitering and Practical Astronomy, complete the course of study as detailed under the second head.

Absence of a proper Staff of Instructors.

This description of the course of instruction is abstracted from the Official Synopsis, and we should observe in reference to it and to the Staff of Instructors provided for the establishment, that, with the exception of the courses in Architecture (which, if correctly described, should be called Building), Surveying, and Practical Astronomy, it would be more accurate to say, that the young Engineer (at all events until very recently) has hitherto received little or no instruction at Chatham. He is only afforded *time*, and he may make out for himself, as he best can, the principles on which the various operations depend; but there are no Professors of Fortification, Military Art, Construction, or Civil Engineering, &c. to set him right, when he is proceeding on erroneous principles, in drawing up the various projects required from him, or to give him information on points on which he may desire it; and, in fact, he is left very much to himself, without any stimulus or definite purpose being placed before him, to induce him to apply himself vigorously to the attainment of a sound knowledge of his profession, both theoretically and practically.

II. *A more extensive Course of Instruction required.*

Additional instruction that should be given.

In addition to the inquiries we thought it necessary to make regarding the qualifications of the young Officers when they joined at Chatham, adverted to at page xliii., we considered it desirable to ascertain whether any additional instruction at that Establishment could be advantageously given, so as to render them better qualified for the proper performance of their various duties, and we now beg to add extracts from some of the opinions with which we have been favoured on this subject:—

Colonel Sandham observes that,—

Vide p. 380.

"Geology, Analytical Chemistry, Photography, the use of the Electric "Telegraph, and Book-keeping, which could be taught with the architectural "course, might be added to the course with advantage."

Colonel Portlock makes the following remarks on the Chatham course:—

"The time, however, has latterly been too short, and the scheme of instruc- "tion is far too limited, not embracing lectures on Military Tactics and Science "(viewed in a general light), nor lectures on Civil Engineering and Architecture. "Professorships in these branches seem absolutely necessary to prepare an "Engineer for the various duties he has to perform."

Lieutenant-Colonel Simmons recommends that the following additions should be made to the existing course:—

Vide p. 356.

"First. A practical acquaintance with the employment and distribution of "labour under various conditions, such as an abundance or a very reduced amount "of tools, animal labour, or practical means, &c., in making field works or per- "manent works, entailing large excavations and embankments in parapets and "ramparts, including the application of modern science as in use in the construc- "tion of large earthworks and excavations of all sorts on railways, and in the "making of docks and breakwaters.

"The best way of acquiring this knowledge is by practical acquaintance with "the subject itself, at present only to be acquired upon the large civil works in "progress in the country. As civil engineers might possibly evince jealousy in "allowing Officers to visit and remain upon these works a sufficient time to allow "of their becoming practically acquainted with their mode of execution, it might "be worthy of consideration whether troops might not be employed, with advant- "age to themselves and to the country, in executing any such works that may "be in course of construction in the country, or even whether it might not be "advantageous on some of the waste lands adjoining some one of the permanent "camps now being established in the country, to make such works, either in the "shape of butts for target-practice, or intrenchments to the camp itself, and so, "at the same time, to instruct Soldiers and Officers of the Army generally in that "important branch of their service, without the application of which they can "scarcely expect to pass through a campaign in actual warfare. It is to be "observed, that a knowledge of this description of work is almost as essential to

" the Soldier and Officer in the state to which war is now reduced as the use of the particular arm they are called upon to use. ROYAL ENGINEERS.

" Secondly. A practical knowledge of road-making, with the study of the materials best adapted for metalling.

" Thirdly. A practical acquaintance with making both floating and standing bridges, and the adaptation of boats and materials of all descriptions to each. This would include a knowledge of the strength and application of materials under the most variable circumstances.

" Fourthly. A far greater practical acquaintance with field-sketching, including the estimation of heights and distances. Upon these sketches the student might be required to indicate the occupation of the ground either for a permanent or temporary camp, due regard being had to drainage and supply of water as well as defence, and the application of fieldworks to strengthen given positions.

" Fifthly. It would appear advisable, if Engineer Officers are to be continued in the construction and charge of barracks, that the Architectural course should be extended. On this subject, however, I speak with extreme diffidence, as my acquaintance with the course does not extend beyond the year 1838."

Captain Galton observes that " he is of opinion that it is possible, and very desirable, to give further instruction to Engineer Officers.

" The profession of an Engineer Officer requires knowledge, first, of military duties, and secondly, of civil duties. *Vide* p. 364.

" A thoroughly practical acquaintance with the first can only be acquired in time of war. Practical knowledge of the second can be given at all times.

" In both, the knowledge of a certain amount of mathematics, modern languages, drawing, history and geography, may be considered essential; these might be taught to a great extent before the State education begins.

" For the efficient performance of both duties, it is essential that the Officers should be conversant with the application of mathematics to every variety of mechanical question; and that they should possess a thorough knowledge of machinery, and of the strength and other qualities of all materials used in engineering works, and the modes in which these materials are worked and applied.

" They should be conversant with Chemistry, Metallurgy, Geology, and Mineralogy.

" This knowledge should be made available by teaching them to design, in a detailed manner, Civil and Military works, according to specified conditions; and it should be still further tested by the construction of large models.

" A knowledge of geology, surveying, and also of practical astronomy, is required in Civil and Military Engineering; Surveying is, I believe, taught efficiently by the present system.

" Fortification, the art of attack, mining, artillery, and instruction in the duties of an Engineer Officer in the field, should be taught in a more comprehensive manner than is at present the case, and castrametation, the duties of the Quartermaster-General's department, military science, tactics, and stategy, in which no instruction whatever is given, should be added to the course.

" I think that the commissions should be given provisionally on leaving the Military College, and not confirmed until the Officers are ready to join the Corps for duty.

" The whole education would not occupy less than three or four years.

" It may be urged that the age at which an Officer would join his Corps after this education, would be greater than that at which it is considered desirable that Line Officers should enter the Army. But it must be recollected that they would be, to all intents and purposes, in the Army, and learning their profession, from the time of passing the first examination."

Whilst Captain Scott, the present Superintendent of Surveying, Practical Astronomy, &c., says:—

" I think that to the present instruction in Practical Architecture should be added a six months' course of Civil Engineering, to be carried on,— *Vide* p. 370.

" 1st. By a series of twelve lectures, well adapted to give an Officer a general view of the nature and extent of the works which in the civil branch of his profession he may be called upon to perform;

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" 2nd. By drawing up abstracts from good professional works, to obtain a " more accurate knowledge of the details of the subjects than could be con- " veyed in the form of lectures ;

" 3rd. By designing and detailing in supplied data, and with the assistance " of good examples, of which descriptions and estimates have been published, " various engineering works of a suitable character ;

" 4th. By visiting, under the guidance of a competent Officer, instructive " Civil Engineering Works ;

" 5th. By a short course of Chemical Analysis, sufficient to enable an Officer " to examine roughly, though with the requisite degree of accuracy for such " a purpose, the various building materials and other bodies with which he may " have to deal, and thus, as far as possible, to supply the want of experience in " judging of their fitness for their intended application ;

" 6th. By a similar course of Practical Geology, carried on chiefly by " examining, under the guidance of a competent Officer, localities rich in " instructive varieties of formation, and making a report on the tract of country " assigned for his military reconnaissance. With many Officers, the great " impediment to study in after life arises from their ignorance of the manner in " which they should set to work.

" These courses would remove the difficulty in two very important branches " of education.

" 7th. By a sufficient degree of experimental instruction in the elements of " Electricity and Magnetism, to enable an Officer to deal intelligently with the " numerous practical engineering applications which these sciences now have.

" Officers have now the means of acquiring a knowledge of Analytical " Chemistry and Magnetism ; but they are not compelled to avail themselves " of them.

" With reference to the second part of the question, I consider the general " mode of instruction pursued here well adapted to the purposes intended ; but " I should recommend that means were granted for enabling experimental con- " structions to be carried on more extensively than at present."

After passing through this course of instruction at Chatham, the young Officer of Engineers must acquire professional information in the best way he can. Colonel Sandham states, in page 386, " Hitherto an Officer has had great " difficulties to contend with in his endeavours to improve himself ; scarcely an " Officer of the Corps could obtain leave of absence from his duties even for " such an object ; this, and the expenses of travelling and of collecting informa- " tion, have almost entirely prevented his seeking information beyond what a " library could afford."

III. *Nature of the Engineer Duties.*

Nature of the duties.

Vide pp. 363, 371.

On quitting Chatham, the young Officer is ordered to some Foreign Colony, or to some out-station in England, Ireland, or Scotland, where his duties are much more nearly allied to those of a Civil than to those of a Military Engineer. He is placed under the command of Officers who design new works, and he has persons under him employed to superintend and to be answerable for carrying out the details of construction. Not indeed that the system under which his duties are carried on bears any close resemblance to that under which the Civil Engineer is employed, for unlike the latter, he is not often placed in a situation where he is required to apply his theoretical knowledge practically, neither is he made responsible for the works carried on under his orders ; and thus he is not placed in a position to gain that practical knowledge, which his education and instruction at Woolwich and Chatham have failed to afford him.

In some instances, he is placed in circumstances where he is obliged to think for himself, by being made responsible for the execution of important works ; but even here complete responsibility is seldom given to him, as he is very liable to be directed to hand them over, in an incomplete state, to a successor, and thus young Officers cease to take interest in the performance of their Professional duties.

Small proportion of the Officers that return a second time to Chatham.

Such Officers as are attached to the Companies of Royal Sappers and Miners, when they return from Foreign Service, accompany them to Chatham, to enable the men to pass through the usual course of Field Instruction ; but the proportion of Officers that return a second time to Chatham, and thus have the

opportunity of keeping up or renewing their knowledge of purely military duties, is exceedingly small; so that when a war breaks out, the rust of years has to be rubbed off, at a very great disadvantage and at a very inconvenient time, and a considerable proportion of the youngest Officers of the Corps are amongst those selected for service in the field.

This small proportion of Officers that revisit Chatham, is, according to the existing system of carrying on the engineer duties, entirely dependent on the small number of Sappers and Miners which are kept up in the British Army, compared with the same force in Foreign Armies; but it certainly need not be made dependent on any such contingency, and we shall presently state in what manner the drawback we have alluded to might be done away with.

IV. *Comparison with the French System at Metz.*

French system of training at Metz.

In France, a very different system is pursued. An elaborate course of Instruction at a School of Application for two years at Metz, after two years of high theoretical teaching at the Polytechnic, is followed by continued practical exercises and theoretical discussions in the various Schools into which the French divide their practical field instruction, until the Officers of Engineers are promoted to the rank of Second Captain. Up to that time they continue to do duty with their men; they are constantly in practical training in military field duties, just as much as the Officers belonging to the Artillery, Infantry, and Cavalry are being trained in their especial duties. The earlier part of the French system of practical instruction, that is, the part carried on at the School of Application at Metz, is especially theoretical. The English system of instruction at Chatham is almost entirely practical, but it requires extension, even as regards the practical part of the Military operations, by the yearly exhibition of sham sieges, in which to be effective, and in accordance with the usual operations of war, the troops of the garrison should be called on to take part, and additional theoretical Professional Instruction is absolutely indispensable.

p. 40.

This will probably be made more apparent by a comparison of the relative amount of the staff employed in instructing the young Officers at Metz, and the young Officers *and the Royal Sappers and Miners* at Chatham.

Comparison of the relative amount of the Staff at Metz and Chatham.

See pages 33, 379.

At Metz for the young Officers *of Artillery and Engineers:*—	At Chatham for the young Officers *and the Royal Sappers and Miners:*—
1 General Officer as Commandant.	1 Colonel as Director.
1 Colonel or Lieut.-Colonel as Second in Command and Director of Studies.	2 Captains as Adjutants.
1 Major of Artillery.	
1 Major of Engineers.	
5 Captains of Artillery.	
3 „ Engineers.	
1 Surgeon.	
INSTRUCTORS.	**INSTRUCTORS.**
9 Professors.	1 Captain. } Recently appointed
4 Assistant Professors.	1 Lieutenant. } Instructors in Field-works, superintendents of the young Officers in the Halls of Study and of the Royal Sappers and Miners in School.
1 Drawing Master. The Professors being principally Captains of Artillery or of Engineers.	1 Captain. Superintendent of Surveying and Practical Astronomy, Chemistry, and Civil Works, and in the Halls of Study.
	1 Captain. Superintending the instruction in the Electric, the Magneto-Electric, and other Field Telegraphs. Recently appointed.
	1 Clerk of Works for the Architectural Course.

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These are quite independent of the Officers who are employed in command of and charged with the instruction of the *men* of the French Engineers, which instruction is carried on quite apart from the School of Application.

The Captains of Companies of Royal Sappers and Miners at Head Quarters take part in the superintendence of their Companies in the schools and in the field, and they are detailed for such special instruction to the junior Officers as may be found most advantageous.

And if even the Staff of Officers employed in giving Instruction in what has hitherto been termed the Practical Class at the Royal Military Academy at Woolwich be added to the number employed at Chatham, the disproportion in the relative numbers of the Instructors in France and England will not be materially lessened.

Indeed it may be broadly and distinctly stated, that until recently, the Royal Engineer establishment at Chatham has only had one Officer specially appointed to afford instruction to the young Officers, viz., the Superintendent for Surveying and Practical Astronomy; and Captain Galton says, "Surveying is, I believe, "efficiently taught by the present system."

V. *Suggestions with regard to the future Instruction.*

Comparing the Establishment at Chatham with the Establishment at Metz, not only as regards the Educational Staff, but also with reference to the subjects and system of Study, and taking into consideration the answers we have received from Officers of Engineers, some of which have been already quoted, we cannot doubt that the Establishment at Chatham is susceptible of considerable improvement: and we would recommend that it should be made thoroughly efficient for the practical application and the extension of the scientific knowledge, which the young Officers should have acquired at a Military Academy or College before they are Provisionally Commissioned.

Appointment of Officers of experience as Instructors, pp. 380, 396, 399.

This may be most efficiently done by the appointment of Officers of experience and acknowledged ability as Instructors in the various branches of study, and by altogether relinquishing the system which has hitherto prevailed of obliging the young Officers to pick up their knowledge on most subjects, as they best can, by referring entirely to books.

and of a Director of Studies.

We also consider that the appointment of Assistant Director (or as we should designate him, Director of Studies), which was abolished in 1821, should be revived.

Necessity for the establishment of a Board of Improvement.

It also seems very desirable to have a Board of Improvement, under the Presidency of the Director of the Establishment, consisting of the Director and Assistant Director, two Officers specially named by the Inspector General of Fortifications to represent the wants of the Service as regards the subjects of Instruction which should be afforded to the Officers of Engineers, and of three of the Instructing Officers. This Board should meet half-yearly, for the purpose of considering what changes should be made, from time to time, in the instruction, in order that the proper representation may be submitted for the consideration of the Superior Authorities.

Deficiencies in the course of Instruction at Chatham. pp. 349, 350, 354, 359, 364, 270, 371, 373, 375, 380, 396.

It appears that the instruction at Chatham is mainly defective as regards the omission of the Higher Branches of Military Science, and that it requires regular courses of study in Fortification and the Attack and Defence of places, Architecture (not merely Building), Construction, Military Art and History, Tactics and Strategy. The study of the sciences of Chemistry, Metallurgy, Geology, and Mineralogy, and that of German and French, should also be continued; and, as we have already observed, properly qualified persons should be appointed to carry on such instruction, which, when once established on a proper footing, and thoroughly systematized, might advantageously be opened to all Officers belonging to the Garrison who desire it.

But we must observe, in addition, that the system itself apparently requires to be essentially changed. Most of the Officers who have been connected with the instruction at Chatham speak of the want of a stimulus to induce the young Officers to exert themselves in pursuing their course of study; and Lieutenant-Colonel M^cKerlie, now one of the Members of the Irish Board of Works, who

was for many years Superintendent of Surveying and Practical Astronomy at Chatham, says:— ROYAL ENGINEERS.

"The course which I would propose to remedy these defects, so far as they result from the system, and, as far as possible, to insure that on leaving Chatham, the Officers should be competent to enter upon their duties as Engineers, would be to specify a time—say fifteen or eighteen months,—within which they should be required to acquire the necessary professional knowledge, and at the end of that time, that they should undergo a searching examination by a Board of Officers altogether unconnected with the Establishment, when, if found qualified, they should be gazetted to the full rank and pay of Lieutenants, their previous rank being only temporary or probationary, with pay as at present. Their studies I would propose to leave in a great degree to the Officers themselves, but would provide ample means for their guidance and assistance through the appointment of competent Officers as superintendents, and by instituting series of lectures on the several branches of study and inquiry. p. 359.

"I do not think it would be desirable to make subject to alteration the relative positions of the Officers as determined on leaving Woolwich, provided the necessary acquirements were attained within the prescribed time; but in the event of an Officer failing in this, unless through sickness, which would 'be 'specially considered,' he would be passed over."

VI. *System recommended to be followed at Chatham.*

It appears to us that these drawbacks would be most effectually removed by fully carrying out, for the Establishment at Chatham, the same principles of management that we have already advocated with reference to the Royal Military Academy, and thus we should recommend that—

1. All young Officers of Engineers that proceed to Chatham for the purpose of receiving instruction at the Royal Engineer Establishment should only be *provisionally* commissioned. The young Officers of Engineers to be *provisionally* commissioned.

2. All of the same promotion should join at the same time, proceed through the same course of instruction, and finally be examined at its close to ascertain the extent to which they have benefited; and we should also recommend, as an additional stimulus, as well as for the more convenient arrangement of the courses of instruction, that the Honourable the Court of Directors of the East India Company, should be invited to concur in an arrangement by which their young Officers of Engineers should join at the same time, and proceed through the same course of instruction. Course of instruction to be followed by an examination.

3. If the results of the examination, which should be conducted in the same manner and on the same principles as we have already explained with regard to the examinations at the Royal Military Academy, prove that there has been gross inattention or gross idleness on the part of any of the young Officers, the permanent Commission might be altogether withheld, or be given under certain modifications in another Arm of the service, as in France, Prussia, and Austria; but we think this course should not be resorted to except on very strong grounds, and with the special sanction of the Commander-in-Chief.

4. The Final Classification in the order of Merit, which should determine the relative positions of the young Officers in their Corps, should depend partly on the marks obtained during this Officer's Examination, and partly on the marks awarded to the Cadet at the Royal Military Academy; the marks obtained at the Academy being added to those awarded for the Final Examination at Chatham. Final classification in order of merit.

5. This final classification for each promotion should also decide who are entitled to receive the *increased rates of pay* awarded to the Engineers

6. The duration of the course would require to be extended to eighteen months, and this period should not be exceeded except for illness. Duration of Course.

7. With the increased force of Officers of Engineers and of the Royal Sappers and Miners at the Establishment consequent on Chatham being made the Head Quarters of the Corps, now styled the Corps of Royal Engineers, we consider that the appointment of a Director of Studies would be highly advantageous; and that Professors or Instructors in Military Art, Strategy, and Tactics, Civil Engineering, Architecture, French and German, should be appointed. Appointment of Director of Studies and additional Instructors.

Necessity for a Lecture Room and Laboratories. p. 380.

Colonel Sandham also calls attention to the necessity for a Lecture Room and Chemical Laboratory, &c., thus:—"As all Engineer Officers on obtaining their "Commissions commence their duties in a state of pupilage at Chatham, I con- "sider it essential that a theatre for lectures, a proper chemical laboratory, and "rooms for the electric telegraph and photographic instruction, should be built; "and that Officers of experience and acknowledged talents should be selected "from the Corps, and employed as Instructors in the subjects that may be from "time to time introduced into the course; such, for instance, as geology, mine- "ralogy, chemistry, photography, the use of the electric and other telegraphs; "and that Officers so selected and employed should receive a liberal remunera- "tion during their employment as Instructors: and I consider that placing every "facility, and affording every reasonable assistance and encouragement to "Officers of Engineers to enable them to collect and impart knowledge and "information, without reference to their length of service, would tend more "than anything to most completely qualify them for the discharge of their "various duties."

Having thus briefly pointed out the changes which should be made in the system to be followed at Chatham, we should add that, it should be made apparent to all, that Officers who continue to study, and thus make themselves fully acquainted with the varied duties of their profession, both theoretically and practically, will, in future, derive advantage from it; and that for such as do so, their superior qualifications will hereafter be held to be the best claim to advancement.

pp. 351, 359, 375, 396.

Recommendation in favour of allowing all Officers of Engineers periodically to revisit Chatham.

If the course of instruction at Chatham be re-organized in the manner we have ventured to recommend, we consider that all Officers of Engineers should, as a rule, be periodically permitted to attend this course of applied study and practical working, and thus have the opportunity of renewing their acquaintance with the ordinary Military Operations of War, and of keeping up their knowledge of Scientific subjects bearing on their Profession.

We are of opinion that the studies which are necessary to young Engineer Officers should be followed by all, and nothing should be left optional or according to their particular wishes.

The case is altogether different as regards the Officers who revisit Chatham, after a period of service in other parts; the true bent of their minds is by that time fully developed and known, and facilities should then be afforded to them for pursuing such studies only as they consider to be most in accordance with their individual tastes and capacities.

pp. 348, 351, 353, 361, 362, 364, 368, 379, 372, 374, 396.

It will be remarked in the evidence, that the Officers of Engineers do not consider that there is any necessity for a distinct Establishment analogous to the Senior Department at Sandhurst, but there is a very general agreement of opinion as to the necessity for a periodical return to Chatham.

The strength of the Corps of Engineers should be such as will admit of this arrangement being made; and by this means, whenever a war again breaks out, a very large body of Officers all perfectly cognizant of Field and Siege operations could at once be made available for military service in the field, their military knowledge being aided and assisted by the experience obtained during their charge of civil works and buildings.

System followed in France. p. 348.

We have thought it necessary to call special attention to the practice followed in the French army, of keeping the young Officers of Engineers constantly doing duty with their men until they attain the rank of Second Captain; but in doing so, it must not be inferred that we consider the French arrangement to be wholly advantageous to the public service: but we have adverted to it mainly to show, in contrast with the English practice, the necessity that exists for allowing our Officers of Engineers to be periodically made conversant with military operations in the field. With such an arrangement as we have suggested, sanctioned and carried into operation, and with certain alterations in the manner of carrying on the Engineer duties, by which the young Officers should have opportunities afforded to them, of being made practically acquainted with the working details of large public undertakings, and by their being made responsible for the works carried on under their orders, so as to induce them to take greater interest in their profession, we should prefer the English to the French system; as it can scarcely be doubted that the more the young Officers are obliged to depend on

their own resources, and the sooner they are accustomed to do so, the greater the probability of their proving efficient public Officers. ROYAL ENGINEERS.

We cannot conclude the subject without calling especial attention to the urgent necessity that exists for affording the young Engineer Officers greater opportunities than they at present possess, of becoming more practically acquainted with the manner of executing extensive new works of various kinds, such as military buildings of all kinds, railways, docks, breakwaters, harbours of refuge, drainage, &c. It is not for us to point out the particular manner in which this should be done, but we could not do less than call attention to the subject. Necessity for giving young Officers more opportunities of obtaining Practical Instruction.

Thus, Sir John Burgoyne states that,—"Every part of the duties of an "Engineer in the field depends essentially on the arts and operations, con- "structive and scientific, that are in constant use in civil life and in peace. "The more, therefore, that Officers of this Corps can be charged with the "designing and practising of those arts and operations in ordinary times, "the more competent they will be for the various calls that may be made "upon them in war. The drills and exercises for the ordinary military "duties of an Engineer in the field are of easy acquirement; but occasions "are numerous where the Officers may be of great service by having a good "knowledge of constructive, geodesical, and other arts and sciences." p. 349.

And Lieutenant-Colonel Simmons observes that "Engineer Officers might "very properly be considered as Government Engineers, to be employed upon "all Government works of every nature, at home and abroad, such as docks, "breakwaters, drainage, surveying, &c. p. 356.

"This measure would probably be attended with great saving to the "country, and the works themselves would be executed equally efficiently, "that is, if a proper system were adopted by the formation of a Central "Board of high science to approve the plans and projects; and throwing the "entire responsibility of the works upon the Officers who plan and execute, "and even making them responsible under penalty of professional disgrace and "dismissal.

"The objection ordinarily made to this practice by the civil profession, viz., "that it would be taking the bread in many cases out of their mouths, ought "not to be listened to, for surely the country, after going to the enormous "expense of educating and maintaining a number of professional men, have an "undoubted right to the employment of their professional services. The true "objection, therefore, hinges upon the question, whether or not a Corps of "Military Engineers is necessary to the Government? A question as to the "reply to which I conceive there can be no shadow of a doubt.

"Much benefit would also accrue to the public service if Officers were "assisted in travelling to visit public works, both civil and military, at home "and abroad. This assistance might be given as a reward to merit, and in all "cases careful reports should be made by the Officers, from which the use they "have made of the opportunities thus given to them might be judged of."

Major Du Cane, R.E., remarks:—"But as it has been found desirable to "employ Officers of Engineers upon duties which do not strictly belong to "their Military Profession, and which come under the head of civil appoint- "ments, and as an Engineer Officer possessed of a certain knowledge of such "duties has a great advantage over, and will be found, especially in some of "our colonies, more useful to the public service than an Officer who does not "possess such knowledge, I am strongly of opinion that instruction, assistance, "and encouragement should be given to Officers of Engineers in the prosecu- "tion of such extra duties. p. 371.

"Among the first of these I would name Civil Engineering, by which term "I mean particularly the construction of railways, machinery, bridges, canals, "dockyards, public buildings, &c.

"Instruction in these subjects might be given at Chatham to the young "Officers on joining, and might be made to form a part of their course, follow- "ing after the military portion.

"I am also of opinion that every means should be afforded to Engineer "Officers to travel through the United Kingdom and on the Continent, so as

MILITARY EDUCATION, ENGLAND.

" to make themselves acquainted with the construction, and principles of construction, of large and important works, Civil and Military.

" This facility is afforded by the Hon. East India Company to their Officers " of Engineers, by the United States and Continental nations to their Officers."

Other testimony to the same effect might be cited.

The question is very fairly put by Lieutenant-Colonel Simmons, whether or not a Corps of Military Engineers is necessary to the Government? If it is necessary, then there can be no doubt that the more they are employed by the Government, the more varied the nature of their duties may be, the more efficient they will be found when the emergency arises for which their services in a purely military capacity are more particularly wanted; and it cannot surely be otherwise than a very mistaken economy, to call in a Civilian to superintend works of a military or *quasi military* character, unless the number of Military Engineers be so limited that none can be obtained when they are wanted.

The question of any re-adjustment of Artillery and Engineer duties not discussed.

We have not thought it consistent with the object for which we were appointed, to attempt to enter into the consideration of the propriety of any re-adjustment of the duties of the two Corps. If the question be brought under consideration, there is very little doubt that the propriety of any changes will be made to rest on well ascertained facts and not on opinions, and if any changes are made, they will probably be based on other grounds than mere educational ones.

We have now gone over the distinct subjects to which our attention was called by our Instructions,—an account of the Military Education adopted in Foreign Countries,—general suggestions with regard to our own Military Education,—and a more detailed plan for the Training of young Officers of the Artillery and Engineers. It is not necessary again to enumerate the recommendations which have been made in different parts of our Report. We shall only state, that having been impressed with the necessity of treating Military Education as a whole, we have urged that it ought to be brought under the direction of a special Department; and that the importance of Military Academies has appeared to us to claim more systematic attention and more real encouragement than they have hitherto received,—and without this we believe it impossible that Military Science can hold its proper place in the Army. The remainder of our Report will contain those details of the Education given in Foreign Academies and in our own, and the Evidence of English Officers, on which we have mainly founded our Recommendations.

(Signed) W. YOLLAND, Lieut.-Colonel, R.E.
W. C. LAKE, M.A., Fellow of Balliol College, Oxford.

For the History and Description of the Foreign Military Schools only.
W. J. SMYTHE, Lieut.-Colonel, R.A.

2, Parliament Street,
12th January 1857.

ACCOUNT

OF THE

MILITARY EDUCATION OF FRANCE, PRUSSIA, AUSTRIA, AND SARDINIA;

TOGETHER WITH A

DESCRIPTION OF ADDISCOMBE AND WOOLWICH;

AND

THE EVIDENCE OF ENGLISH OFFICERS.

FRANCE.

FRANCE.

The French Armies are officered in a fixed proportion from the ranks and from the Military Schools.

The French armies, as is well known, are composed of soldiers levied by yearly conscription for a service of seven years. Substitutes are allowed, but in accordance with a recent alteration, they are selected by the State. Private arrangements are no longer permitted; a fixed sum is paid over to the authorities, and the choice of the substitutes, as in Austria, made by them.

The troops are officered partly from the Military Schools and partly by promotion from the ranks. The proportions are established by law. One-third of the commissions are reserved for the Military Schools, and one-third left for the promotion from the ranks. The disposal of the remaining third part is left to the Emperor. In actual practice, it is said that two-thirds of the officers in the Artillery and Engineers are taken from the pupils of the Polytechnic and one-third only from the ranks; in the Line, on the other hand, about two-thirds are promoted from the ranks, and one-third only have gone through St. Cyr. But it must also be added, that we were informed that only a very small proportion of those promoted from the ranks rise above the rank of Captain in any of the Services.

Rules of Promotion.

The promotion is partly by seniority (*ancienneté*) and partly by selection (*choix*).

The following regulations exist as to the length of service in each rank before promotion can be given, during a period of peace:—

A second Lieutenant cannot be promoted to Lieutenant under 2 years' service.

A Lieutenant	„	„	Captain	„	2	„
A Captain	„	„	Major	„	4	„
A Major	„	„	Lieut.-Col.	„	3	„
A Lieut.-Colonel	„	„	Colonel	„	2	„

But in time of war these regulations are not in force.

Up to the rank of Captain, two-thirds of the promotion takes place according to seniority, and the other one-third by selection.

From the rank of Captain to that of Major (*chef de bataillon ou d'escadron*) half of the promotion is by seniority and the other half by selection, and from Major upwards, it is entirely by selection.

Annual Inspection.

The steps which lead to the selection are as follows:—The General Officers appointed by the Minister at War to make the Annual Inspections of the several Divisions of the Army of France, who are called Inspectors-General, as soon as they have completed their tours of inspection, return to Paris and assemble together for the purpose of comparing their notes respecting the officers they have each seen, and thus prepare a list arranged in the order in which they recommend that the selection for promotion should be made.

We were informed that the present Minister of War almost invariably promoted the officers from the head of this list, or, in other words, followed the recommendation of the Inspectors-General.

We also made inquiries as to the way in which the Inspectors-General obtained information to enable them to give an accurate report of the qualifications and conduct of the officers; we were led to believe that they founded their judgments partly on personal observation, partly, and especially in the case of the junior ranks, from the statements made by the Colonels and superior officers, no examination of any kind taking place as a condition or preliminary to advancement.

List of the Military Schools.

The principal Military Schools at present existing in France are the following:—

1. The Polytechnic School at Paris (*Ecole Impériale Polytechnique*), preparatory to—
2. The Artillery and Engineers School of Application at Metz (*Ecole Impériale d'Application de l'Artillerie et du Génie*).
3. The Military School at St. Cyr (*Ecole Impériale Spéciale Militaire*), for the Infantry and Cavalry, into which the Officers' Department of the Cavalry School at Saumur has lately been absorbed.

4. The Staff School at Paris (*Ecole Impériale d'Application d'Etat Major*).
5. The Military Orphan School (*Prytanée Impériale Militaire*) at La Flèche.
6. The Medical School (*Ecole Impériale de Médecine et de Pharmacie Militaires*), recently established in connexion with the Hospital of Val-de-Grâce.
7. The School of Musketry (*Ecole Normale de Tir*) at Vincennes, founded in 1842.
8. The Gymnastic School (*Ecole Normale de Gymnastique*) near Vincennes.
9. The Music School (*Gymnase Musical*)
10. The Regimental Schools (*Ecoles Régimentaires*).

Their Management.

The Military Schools are under the charge of the Minister of War, with whom the authorities of the schools are in direct communication.

Their Cost to the State.

The expenses to the State of the Military Schools, including the pay of the military men who are employed in connexion with them, for the year 1851, as extracted from the "Comptes-Généraux, presentés par le Ministre de la Guerre," are as follows:—

Name of School.	Expenses of the Schools.	Military Pay.	Total.	Number of Officers or Students under instruction.	Total Students.
	Fr.	Fr.	Fr.*		
Ecole Polytechnique -	496,442·23	58,469·68	554,911·91	For 55 boursiers, 10 demi-boursiers, and 128 paying pupils.	193
Ecole Spéciale Militaire -	521,309·92	160,877·43	682,187·35	For 133 boursiers, 54 demi-boursiers, and 304 paying pupils.	491
Collége Militaire - -	321,461·13	54,994·06	376,810·19	For 283 boursiers, 82 demi-boursiers, and 8 paying pupils.	373
Ecole de Cavalerie - -	182,764·73	13,405·54	196,170·27	For 89 Sub-lieutenants, 282 pupil-teachers, and 86 pupil-farriers.	457
Ecole d Application d'Etat Major.	48,786·21	96,563·75	145,349·96	For 50 student officers - - -	50
Ecole d'Application de l'Artillerie et du Génie.	87,290·00	100,062·06	187,352 06	For 83 Sub-lieutenants of Artillery, and 47 of Engineers.	130
Gymnase Militaire et Ecole de Tir.	33,211·33	—	—	—	—
Ecoles Régimentaires de l'Infanterie et de la Cavalerie.	108,911·30	—	—	—	—
Total - - -	1,800,176·85	424,372·52	2,224,549·37	Total - -	1,694

	Fr.	Fr.
From this total amount - - - - - -		2,224,542·37
Deduct the sums received from the paying students, amounting—		
For the Ecole Polytechnique to -	130,377·99	
„ Ecole Spéciale Militaire -	224,220·75	
„ Collége Militaire - - -	26,841·83	
Ecole de Cavalerie, repayment of the cost of maintaining the students - -	39,800·00	
		421,240·57
The total cost to the State appears to be - -		1,803,308·80

or rather more than 72,000*l.* for the year 1851. But it must be remarked, on the one hand, that the expenses of the Cavalry School are considerably reduced, and on the other, that at the time of our visit we found the students in the Polytechnic School amount to 330 instead of 193; at St. Cyr (Ecole Spéciale Militaire), to 800 instead of 491, and at the Staff School to 90 instead of 50. It is possible, however, that the expenditure of 1851 may be regarded as the ordinary charge in time of peace.

The average annual cost of a student to the State in these schools, after deducting the sums received from paying pupils, appears to be as follows:—

	£	*s.*	*d.*
Ecole Polytechnique - - - -	91	13	0
Ecole Spéciale Militaire (St. Cyr) - -	38	17	3
Collége Militaire (La Flèche) - -	39	1	10
Ecole de Cavalerie (Saumur) - -	14	5	4
Ecole d'Application d'Etat Major - -	121	2	6
Ecole d'Application de l'Artillerie et du Génie	60	1	0

It must, however, be recollected, with reference to the Polytechnic, St. Cyr, and the Schools of Application for the Artillery and Engineers at Metz, and for the Staff at Paris, that the expense is limited to two years for each student; so that, assuming the expenditure for the year 1851 to be a fair average in time of peace, the cost to the State of training an Officer of Artillery and Engineers

* One Franc is nearly equal to Ten Pence of English money.

would amount to rather more than 300*l.*, and that of an Officer of the Staff to upwards of 280*l.*

Visits made by the Commission.

Of these institutions we visited, and propose to describe, the Polytechnic, the Artillery and Engineers School of Application at Metz, the general Military School at St. Cyr, the Staff School at Paris, and an Engineers Regimental School at Metz. Opportunity was also taken to see the Schools of Civil Engineering (the Mines, and the Roads and Bridges) connected with the Polytechnic, and also to visit the School of Musketry at Vincennes, of which last some account will be given.

Arrangement followed in the account.

It may be also well to explain the principle upon which we have arranged the account of the French Schools, as it somewhat differs from that which will be followed in describing the Prussian and Austrian Education. We have taken the Polytechnic first on account of its distinction and importance. It is followed by the School of Application at Metz, to which it leads, and with which in every way it is closely connected. Immediately after these we introduce the opinions of some high authorities in France with regard to the effect of their peculiar teaching on the Special Arms of the French Service. We next proceed to the Special Military School for the Officers of the French Army, St. Cyr; and we follow this up by an account of the School for the Staff, appointments to which are the reward of distinction at St. Cyr.

We have appended an account of the Lycées, the public schools of civil education in France, and of the private preparatory institutions. In the former as well as in the latter the instruction is greatly influenced by that given in the Military Schools. In connexion with these follows a notice of the Collége Militaire, maintained for the sons of military men, but not otherwise a Military School, at La Flèche; and lastly will be found the report of the visit made to the School of Musketry at Vincennes.

At first sight it may appear as if an almost excessive degree of attention had been given to the Polytechnic, an institution not exclusively of a military character. But the celebrity of the School, and the reference to it in our letter of instructions, called our especial attention to it; and when we add that almost every question connected with the studies required for officers in the two special corps has received, in the case of this scientific school, more thorough and more open consideration and discussion than elsewhere, we consider that we have shown sufficient grounds for the full details into which we have entered.

THE POLYTECHNIC SCHOOL.

A general Scientific School.

This, which perhaps without exaggeration may be termed the greatest Mathematical School in the world, is mainly a preparatory school for those branches of the French army which are specially termed scientific, inasmuch as three-fourths of its pupils enter the corps of Artillery, the Engineers, and the Staff. But it also exclusively supplies some important departments of the Civil Service. And this peculiarity in its constitution—partly accidental, and partly characteristic of the French system of centralization—affects in various ways its instruction, by giving a mixed civil and military object, and mixed civil and military prizes to the Institution. It raises its scientific teaching to a height which it will be difficult for any purely military school to attain, and which, at all events, in point of fact, no other military school in the world *has* attained, or perhaps even thought desirable.

We shall proceed to describe this school under the following heads:—

1st. Its foundation and history.
2nd. An outline of the management and the establishment of the school, and a list of the public services supplied by it.
3rd. The conditions and examinations for admission.
4th. The school buildings, and the course and method of study.
5th. The examinations, particularly that of the first year and the final one.
6th. General remarks.

I. *Foundation and History.*

Its origin in the time of the first Revolution, under Carnot and the Committee of Public Safety, as a Central School of Public Works.

Its origin dates from a period of disorder and distress in the history of France which might seem alien to all intellectual pursuits, if we did not remember that the general stimulus of a revolutionary period often acts powerfully upon thought and education. It is, perhaps, even more than the Institute, the chief scientific creation of the first French Revolution. It was during the government of the Committee of Public Safety, when Carnot, as War Minister, was gradually driving back the invading armies, and reorganizing victory out of defeat and confusion, that the first steps were taken for its establishment. A law, dating the 1st Ventose, year II., the 12th of March 1794, created a "Commission des Travaux "Publics," charged with the duty of establishing a regular system for carrying on public works; and this Commission ultimately founded a central School for Public Works, and drew up a plan for the competitive examination of candidates for admission to the service. It was intended at first to give a complete education for some of the public services, but it was soon changed into a Preparatory School, to be succeeded by Special Schools of Application. This was the Ecole Polytechnique.

Its mixed character, military and civil,

as a School of Engineers, and of Artillery;

The school and its plan were both owing to an immediate and pressing want It was to be partly military and partly civil. Military, as well as civil education had been destroyed by the revolutionists. The Committee of Public Safety had, indeed, formed a provisional school for Engineers at Metz, to supply the immediate wants of the army on the frontier—and at this school young men were hastily taught the elements of fortification, and were sent direct to the troops, to learn as they best could, the practice of their art. "But such a "method," says the Report accompanying the law which founded the School, "does not form Engineers in any true sense of the term, and can only be justi-"fied by the emergency of the time. The young men should be recalled to "the new school to complete their studies." Indeed no one knew better than Carnot, to use the language of the report, "that patriotism and courage cannot "always supply the want of knowledge;" and in the critical campaigns of 1793–4, he must often have felt the need of the institution which he was then contributing to set on foot. Such was the immediate motive for the creation of this school. At first, it only included the Engineers amongst its pupils. But the Artillery were added within a year.

and as a Scientific Institution.

We must not however omit to notice its civil character, the combination of which with its military object forms its peculiar feature, and has greatly contributed to its reputation. Amongst its founders were men, who though ardent revolutionists, were thirsting for the restoration of schools and learning, which for a time had been totally extinguished. The chief of these, besides Carnot, were Monge and Fourcroy, Berthollet and Lagrange. Of Carnot and

Its founders.

Lagrange, one amongst the first of War Ministers, the other one of the greatest of mathematicians, we need not say more. Berthollet, a man of science and practical skill, first suggested the school; Monge, the founder of Descriptive Geometry, a favourite *savant* of Napoleon though a zealous republican, united to real genius that passion for teaching and for his pupils, which makes the *beau idéal* of the founder of a school; and Fourcroy was a man of equal practical tact and science, who at the time had great influence with the Convention, and was afterwards entrusted by Napoleon with much of the re-organization of education in France.

Previous destruction of educational institutions.

When the school first started there was scarcely another of any description in the country. For nearly three years the Revolution had destroyed every kind of teaching. The attack upon the old schools, in France, as elsewhere, chiefly in the hands of the clergy, had been begun by a famous report of Talleyrand's, presented to the Legislative Assembly in 1791,* which recommended to suppress all the existing academies within Paris and the provinces, and to replace them by an entirely new system of national education through the country. In this plan a considerable number of military schools were proposed, where boys were to be educated from a very early age. When the violent revolutionists were in power, they adopted the destructive part of Talleyrand's suggestions without the other.† All schools, from the University downwards, were destroyed; the large exhibitions or *Bourses*, numbering nearly 40,000, were confiscated or plundered by individuals, and even the military schools and those for the public works (which were absolutely necessary for the very roads and the defence of the country) were suppressed or disorganized. The School of Engineers at Mézières (an excellent one, where Monge had been a professor), and that of the Artillery at La Fère, were both broken up, whilst the murder of Lavoisier, and the well-known saying with respect to it, that "the "Republic had no need of chemists," gave currency to a belief, which Fourcroy expressed in proposing the Polytechnic, "that the late conspirators had formed "a deliberate plan to destroy the arts and sciences, and to establish their tyranny "on the ruins of human reason."

Introduction of the principle of Public Competition, and early energy of the School.

Thus it was on the ruin of all the old teaching, that the new institution was erected; a truly *revolutionary* school, as its founders delighted to call it, using the term as it was then commonly used, as a synonym for all that was excellent. And then for the first time avowing the principle of Public Competition, its founders, Monge and Fourcroy, began their work with an energy and enthusiasm which they seem to have left as a traditional inheritance to their school. It is curious to see the difficulties which the bankruptcy of the country threw in their way, and the vigour with which, assisted by the summary powers of the republican government, they overcame them. They begged the old Palais Bourbon for their building,—were supplied with pictures from the Louvre,—the fortunate capture of an English ship gave them some uncut diamonds for their first experiments,—presents of military instruments were sent from the arsenals of Havre,—and even the hospitals contributed some chemical substances. In fine, having set their school in motion, the Government and its professors worked at it with such zeal and effect, that within five months after their project was announced, they had held their first entrance examination, open to the competition of all France, and started with 379 pupils.

Spirit of its early Pupils and Professors.

The account of one of these first pupils, who is among the most distinguished still surviving ornaments of the Polytechnic, will convey a far better idea of the spirit of the young institution than could be given by a more lengthy description. M. Biot described to us vividly the zeal of the earliest teachers, and the thirst for knowledge which, repressed for a while by the horrors of the period, burst forth with fresh ardour amongst the French youth of the time. Many of them, he said, like himself, had been carried away by the enthusiasm of the Revolution, and had entered the army. "My father had sent me," he added, "to a mercan- "tile house, and indeed I never felt any great vocation to be a soldier, but *Que* "*voulez vous? les Prussiens etaient en Champagne.*" He joined the army, served two years under Dumouriez, and returned to Paris in the Reign of Terror, "to "see from his lodgings in the Rue St. Honoré the very generals who had led "us to victory, Custine and Biron, carried by in the carts to the guillotine.

Anecdote of M. Biot.

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* *See* Rapport sur l'Instruction Publique, par M. Talleyrand Perigord.

† *See* M. Villemain's Rapport du Projet de Loi. 1844.

" Imagine what it was when we heard that Robespierre was dead, and that we " might return safely to study after all this misery, and then to have for our " teachers La Place, Lagrange, and Monge. We felt like men brought to life " again after suffocation. Lagrange said modestly, Let me teach them arith- " metic. Monge was more like our father than our teacher; he would come " to us in the evening, and assist us in our work till midnight, and when he " explained a difficulty to one of our *chefs de brigade*, it ran like an electric " spark through the party." The pupils were not then, he told us, as they have since been, shut up in barracks, they were left free, but there was no idleness or dissipation amongst them. They were united in zealous work and in good *camaraderie*, and any one known as a bad character was avoided. This account may be a little tinged by enthusiastic recollections, but it agreed almost entirely with that of M. de Barante, who bore similar testimony to the early devotion of the pupils, and the unique excellence of the teaching of Monge.

Particular points to be observed in the early history of the School.

We are not, however, writing a history of this school, and must confine ourselves to such points as directly illustrate its system of teaching and its organization. These may be roughly enumerated in the following order.

1. The Law of 1799, which determined the system of government and the teaching of the School.

1. Its early history is completed by the Law of its Organization, given it by La Place in his short Ministry of the Interior. This occurred in the last month of 1799, a memorable era in French history, for it was immediately after the revolution of the 18th of Brumaire, when Napoleon overthrew the Directory and made himself First Consul. One of his earliest acts was to sign the charter of his great civil and military school.* This charter or decree deserves some attention, because it is always referred to as the law of the foundation of the school. It determined (*a*) the composition of the two Councils of Instruction and Improvement, the bodies to which the direction of the school was to be, and still is, entrusted; (*b*) some of its marked peculiarities in the mode and subjects of teaching. It is important to notice each of the two points.

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* *See* Fourcy, Histoire de l'Ecole Polytechnique, p. 192. The connexion of the early history of the School with the sequence of public events may be best shown by a Table:

Commencement of the French Republic	22d September 1792	1st Vendémiaire I.
Commencement of the Government of the New Committee of Public Safety, composed of Robespierre, St. Just, &c.; Invasion of France	October 1793	Brumaire II.
Decree forming a Committee of Public Works, amongst whose duties was included that of founding a School of Public Works; Victories on the frontier under Carnot's ministry	12th March 1794	21st Ventôse II.
Fall of Robespierre	26th July 1794	8th Thermidor II.
The Report of the Committee of Public Works is presented to the Convention	24th September 1794	3d Vendémiaire III.
Decree for founding a School of Public Works for the five Services, of Military Engineering, Roads, Mines, Maps, and Ship-building	28th September 1794	7th Vendémiaire III.
Ordinance for the Organization of the School (The School opens about the same date.)	26th November 1794	6th Frimaire III.
Law for the establishment of Schools of Application; the Course at the School of Public Works is shortened, in consequence, to two instead of three years, and it receives the name of the Polytechnic School	14th October 1795	22d Vendémiaire IV.
Close of the Convention; Government of the Directory	26th October 1795	5th Brumaire IV.
. . . . .	. . . . .	. . . . .
Napoleon returns from Egypt; Fall of the Directory; Government of the Consulate	9th November 1799	18th Brumaire VIII.
Law for the Re-organization of the Polytechnic School, under La Place's Ministry	16th December 1799	25th Frimaire VIII.
Battle of Marengo	14th June 1800	25th Prairial VIII.
First Meeting of the *Conseil de Perfectionnement*	22d October 1800	1st Brumaire IX.
Union of the Schools of Application for the Artillery and Engineers at Metz	3d October 1802	12th Vendémiaire XI.
Establishment of the Empire	18th May 1804	2d Floréal XII.
Commencement of the *casernement*	November 1805	Brumaire XIII.

The system is spoken of as complete in the year 1809.

The order of the French Republican months is as follows:—Vendémiaire, Brumaire, Frimaire, Nivôse, Pluviôse, Ventôse, Germinal, Floréal, Prairial, Messidor, Thermidor, Fructidor. They contain thirty days each, and the year is completed by five extra days inserted at the end, between the 17th and the 22d of September.

(a.) The direction of the school was at first almost entirely in the hands of its professors, who formed what is still called its Council of Instruction. Each of them presided over the school alternately for one month, a plan copied from the revolutionary government of the Convention. In the course of a few years, however, another body was added, which has now the real management of the school. This is called the "Council of Improvement" (*Conseil de perfectionnement*), and a part of its business is to see that the studies form a good preparation for those of the more special schools (*ecoles d'application*) for the civil and military service. It consists of eminent men belonging to the various public departments supplied by the school, and some of the professors. It has had, as far as we could judge, an useful influence; *first*, as a body not liable to be prejudiced in its proposals by the feelings of the school, and yet interested in its welfare and understanding it; *secondly*, as having shown much skill in the difficult task of making the theoretical teaching of the Polytechnic a good introduction to the practical studies of the public service; *thirdly*, as being sufficiently influential, from the character of its members, to shield the school from occasional ill-judged interference. It should be added that hardly any year has passed without the Council making a full report on the studies of the school, with particular reference to their bearing on the Special Schools of Application.

Government of the School by the *Conseil de Perfectionnement*. Use of this Council.

(b.) The method of scientific teaching has been peculiar from the beginning. It is the most energetic form of what may be called the *repetitorial* system, a method of teaching almost peculiar to France, and which may be described as a very able combination of professorial and tutorial teaching. The object of the *répétiteur*, or private tutor, is to second every lecture of the Professor, to explain and fix it by ocular demonstration, explanations, or examination. This was a peculiarity in the scheme of Monge and Fourcroy. The latter said, in the first program, "Our pupils must not only learn, they must at "once carry out their theory. We must distribute them into small rooms, "where they shall practise the plans of descriptive geometry, which the "professors have just shown them in their public lectures. And in the same "manner they must go over in practice (*répéteront*) in separate laboratories the "principal operations of chemistry."* To carry out this system the twenty best pupils, of whom M. Biot was one, were selected as *répétiteurs* soon after the school had started. Since then the vacancies have always been filled by young but competent men, aspiring themselves to become in turn professors. They form a class of teachers more like the highest style of private tutors in our Universities, or what are called in Germany *Privat-docenten*, than any other body,—with this difference, that they do not give their own lectures, but breaking up the Professor's large class into small classes of five and six pupils, examine these in *his* lecture. The success of this attempt we shall describe hereafter.

The system of teaching was a very peculiar one, and was carried on by *Répétiteurs*.

2. A change may be noticed which was effected very early by the Council of Improvement—the union of pupils for the Artillery and Engineers in a single School of Application. The first report in December 1800, speaks of the identity in extent and character of the studies required for these two services; and in conformity with its recommendation, the law of the 3d of October 1802, (12th Vendémiaire, XI.) dissolved the separate Artillery school at Châlons, and established the united school for both arms in the form which it still retains at Metz.

2. Union of the Artillery and Engineer Students in a single School of Application.

3. In 1805 a curious change was made, and one very characteristic of the school. The pupils have always been somewhat turbulent, and generally on the side of opposition. In the earliest times they were constantly charged with *incivisme*, and the aristocracy was said to have "taken refuge within its walls." In fact, one of its earliest and of its few great *literary* pupils, M. de Barante, confirmed this statement, adding, as a reason, that the school gave for a while the only good instruction in France. It was in consequence of some of these charges that the pupils who had hitherto lived in their own private houses or lodgings in Paris, were collected in the school building. This "*casernement*," said to be immediately owing to a burst of anger of Napoleon, naturally tended to give the school a more military character; but it was regarded as an unfortunate change by its chief scientific friends. "*Ah! ma pauvre école!*" M. Biot told us he had exclaimed, when he saw their knapsacks on their beds. He felt, he said, that the enthusiasm of free study was gone, and that now they would chiefly work by routine and compulsion.

3. The Students are lodged in the building (the *Casernement*).

* Fourcy, Histoire de l'Ecole Polytechnique, p. 17.

4. Close of its early history in 1809.

4. The year 1809 may be called the epoch at which the school attained its final character. By this time the functions, both of Boards and teachers, were accurately fixed, some alterations in the studies had taken place, and the plan of a Final Examination had been drawn up, according to which the Pupils were to obtain their choice of the branch of the Public Service they preferred. In fact, the school may be said to have preserved ever since the form it then assumed, under a variety of Governments and through various revolutions, in most of which, indeed, its pupils have borne some share; and one of which, the restoration of 1816, was attended with its temporary dissolution.

General review.

Thus, during the first years after its foundation the Polytechnic grew and flourished in the general dearth of public teaching, being indeed not merely the only great school, but, until the Institute was founded, the only scientific body in France. Working on its first idea of high professorial lectures, practically applied and explained by *répétiteurs*, its success in its own purely scientific line was, and has continued to be, astonishing. Out of its sixteen earliest professors, ten still retain an European name. Lagrange, Monge, Fourcroy, La Place, Guyton de Morveau were connected with it. Malus, Hauy, Biot, Poisson, and De Barante, were among its earliest pupils. Arago, Cauchy, Cavaignac, Lamoricière, with many more modern names, come later. All the great Engineers and Artillerymen of the empire belonged to it, and the long pages in its calendar of distinguished men are the measure of its influence on the civil and military services of France. In fact its pupils, at a time of enormous demands, supplied all the scientific offices of the army, and directed all the chief public works, fortresses, arsenals, the improvement of cities, the great lines of roads, shipbuilding, mining,—carried out, in a word, most of the great improvements of Napoleon.* He knew the value of his school, "the hen" as he called it, "that "laid him golden eggs,"—and perhaps its young pupils were not improved by the excessive official patronage bestowed by him upon "the envy of Europe," "the first school in the world." It cannot, however, be matter of surprise, that its vigour and success should have caused Frenchmen, even those who criticise its influence severely, to regard it with pride as an institution unrivalled for scientific purposes.

Importance of the School to Napoleon, and his estimate of it.

Later History. Disputes on the best mode of harmonising the teaching with that of the special Schools of Application.

It is not necessary to give any detailed account of the later history of the School, but we must remark that disputes have frequently arisen with regard to the best mode of harmonising its teaching with that of the Special Schools of Application to which it conducts. These disputes have been no doubt increased by the union of a civil and military object in the same school. The scientific teaching desirable for some of the higher civil professions has appeared of doubtful advantage to those destined for the more practical work of war. There has been always a desire on the one side to qualify pure mathematics by application, a strong feeling on the other that mathematical study sharpens the mind most keenly for some of the practical pursuits of after life. We should add, perhaps, that there has been some protest in France (though little heard among the scientific men who have been the chief directors of the school) against the *esprit faux*, the exclusive pursuit of mathematics to the utter neglect of literature, and the indifference to moral and historical studies. Some one or other of these complaints any one who studies the *literature*, the pamphlets, and history of the school will find often reproduced in the letters of War Ministers, of Artillery and Engineer officers commanding the School of Application at Metz, or of Committees from the similar schools for the Mines and the Roads and Bridges. The last of these occasions illustrates the present position of the School.

The Mixed Commission of 1850.

On the 5th of June 1850, the Legislative Assembly appointed a Mixed Commission of military men and civilians, who were charged to revise all the programs of instruction, and to recommend all needful changes in the studies of the pupils, both those preparatory to entrance and those actually pursued in the school. The Commission was composed as follows :—

M. Thenard, Member of the Academy of Sciences, and of the Board of Improvement of the Polytechnic School, President.
Le Verrier, Member of the Academy of Sciences and of the Legislative Assembly, Reporter.
Noizet, General of Brigade of Engineers.

* *See* the striking account in Alison's History of Europe, vi. 398. 1st edition. 8vo.

Poncelet, General of Brigade of Engineers, Commandant of the Polytechnic School, Member of the Academy of Sciences.
Piobert, General of Brigade of Artillery, Member of the Academy of Sciences.
Mathieu, Rear Admiral.
Duhamel, Member of the Academy of Sciences, Director of Studies at the Polytechnic School.
Mary, Divisional Inspector of Roads and Bridges.
Morin, Colonel of Artillery, Member of the Academy of Sciences.
Regnault, Engineer of Mines, Member of the Academy of Sciences.
Olivier, Professor at the *Conservatoire des Arts et Metiers.*
Debacq, Secretary for Military Schools at the Ministry of War, Secretary.

Its results in favour of applied Science.

A chronic dispute which has gone on from the very first year of the school's existence between the exclusive study of abstract mathematics on the one hand, and their early practical application on the other, was brought to a head (though it has scarcely been set at rest) by this Commission. All the alterations effected have been in the direction of eliminating a portion of the pure mathematics, and of reducing abstract study to the limits within which it was believed to be most directly applicable to practice. The results, however, are still a subject of vehement dispute, in which most of the old scientific pupils of the Polytechnic, and many of what may be styled its most practical members, the officers of the Artillery and Engineers, are ranged on the side of "early and deep scientific study *versus* early practical applications." It is, indeed, a question which touches the military pupils nearly, since it is in their case particularly that the proposed abstract studies of the Polytechnic might be thought of the most doubtful advantage. We do not try to solve the problem here, though the facts elsewhere stated will afford some materials for judgment. We incline to the opinion of those who think that the ancient *genius loci*, the traditional teaching of the school, will be too strong for legislative interference, and that, in spite of recent enactments, abstract science and analysis will reign in the lecture-rooms and halls of study of the Polytechnic, now as in the days of Monge.

Disputes still continue with regard to the high scientific teaching.

II. *An Outline of the Management and of the Establishment of the School, &c.*

Branches of the Public Service for which the Polytechnic gives preparatory instruction.

The Polytechnic, as we have said, is a preparatory and general scientific school; its studies are not exclusively adapted for any one of the departments to which at the close of its course the scholars will find themselves assigned: and on quitting it they have, before entering on the actual discharge of their duties of whatever kind, to pass through a further term of teaching in some one of the Schools of Application specially devoted to particular professions.

The public services for which it thus gives a general preparation are the following:—

Military:	
Artillery (*Artillerie de terre*)	Under the Minister at War.
Engineers (*Génie*)	
The Staff Corps (*Corps d'Etat Major*)	
The Department of Powder and Saltpetre (*Poudres et Salpêtres*)	
Navy (*Marine*)	Under the Minister of Marine.
Marine Artillery (*Artillerie de mer*)	
Naval Architects (*Génie maritime*)	
The Hydrographical Department (*Corps des Ingénieurs Hydrographes*)	
Civil:	
The Department of Roads and Bridges (*Ponts-et-chaussées*)	Under the Minister of Public Works.
The Department of Mines (*Mines*)	
The Telegraph Department (*Lignes Télégraphiques*)	Under the Minister of the Interior.
The Tobacco Department (*Administration des Tabacs*)	Under the Minister of Finance.

To these may be added at any time, by a decree on the part of the Government, any other Departments, the duties of which appear to require an extensive knowledge of mathematics, physics, or chemistry.

Conditions of admission.

Admission to the school is, and has been since its first commencement in 1794, obtained by competition in a general examination, held yearly, and open to all. Every French youth, between the age of 16 and 20 (or if in the Army up to the age of 25), may offer himself as a candidate.

A Board of Examiners passes through France once every year, and examines all who present themselves, that have complied with the conditions, which are fully detailed in the Decree given in the Appendix. It commences at Paris.

A list of such of the candidates as are found eligible for admittance to the Polytechnic is drawn up from the proceedings of the Board, and submitted to the Minister at War; the number of places likely to be vacant has already been determined, and the Minister fixes the number of admissions accordingly. The candidates admitted are invariably taken in the order of merit.

Annual charge.

The annual charge for board and instruction is 40*l.* (1,000 fr.), payable in advance in four instalments. In addition there is the cost of outfit, varying from 20*l.* to 24*l.* Exhibitions, however, for the discharge of the whole or of one-half of the expense (*bourses* and *demi-bourses*), are awarded by the State in favour of *all* the successful candidates, whose parents can prove themselves to be too poor to maintain their children in the school. Outfits and half outfits (*trousseaux* and *demi-trousseaux*) are also granted in these cases, on the entrance of the student into the school: and the number of these *boursiers* and *demi-boursiers* amounts at the present time to one-third of the whole.

Duration of course.

The course of study is completed in two years. On its successful termination, which is preceded by a Final Examination, the students are distributed into the different services, the choice being offered them in the order of their merit, as laid down in the classified list drawn up after the Examination. If it so happen that the number of places or the services which can be offered is not sufficient for the number of qualified students, those at the bottom of the list are offered service in the infantry or cavalry, and those who do not enter the public service, are supplied with certificates of having passed successfully through the school. Students who have been admitted into the school from the army, are obliged to re-enter the army.

Promotion to the Public Services.

All others, as has been said, have the right of choosing, according to their position on the list, the service which they prefer, so far, that is, as the number of vacancies in that service will allow; or they may if they please decline to enter the public service at all.

Establishment;

Such is a general outline of the plan and object of the school. We may add that, besides its military staff, it employs no less than 39 professors and teachers; that it has four Boards of Management, and that ten scientific men unconnected with the school, and amongst the most distinguished in France, conduct its examinations. The magnitude of this establishment for teaching may be estimated by the fact, that the number of pupils rarely exceeds 350, and is often much less.

A fuller enumeration of these bodies will complete our present sketch.

Military,

i. The Military Establishment consists of:—

The Commandant, a General Officer, usually of the Artillery or the Engineers, at present a General of Artillery.

A Second in Command, a Colonel or Lieutenant-Colonel, chosen from former pupils of school; at present a Colonel of Engineers.

Three Captains of Artillery and Three Captains of Engineers, as Inspectors of Studies, chosen also from former pupils of the school.

Six Adjutants (*adjoints*), non-commissioned officers, usually such as have been recommended for promotion.

and Civil.

ii. The Civil Establishment consists of:—

1. A Director of Studies, who has generally been a civilian, but is at present a Lieutenant-Colonel of Engineers.

2. Fifteen Professors, viz.:—Two of Mathematical Analysis. Two of Mechanics and Machinery. One of Descriptive Geometry. Two of Physics. Two of Chemistry. One of Military Art and Fortification. One of Geodesy. One of Architecture. One of French Composition. One of German. One of Drawing. Of these one is an officer of the Staff, another of the Artillery, and a third of the Navy; two are Engineers in

Chief of the Roads and Bridges; nine are civilians, of whom two are Members of the Academy of Sciences.

3. Three Drawing Masters for Landscape and Figure Drawing; one for Machine Drawing, and one for Topographical drawing.

4. Nineteen Assistant and Extra Assistant Teachers (*répétiteurs* and *répétiteurs adjoints*) whose name and functions are both peculiar.

5. Five Examiners for Admission, consisting at present of one Colonel of Artillery, as President, and four civilians.

6. Five Examiners of Students (civilians), four of them belonging to the Academy of Sciences.

7. There is also a separate Department for the ordinary Management or Administration of the affairs of the school, the charge of the fabric and of the library and museums; and a Medical Staff.

iii. The general control or supervision of the school is vested, under the War Department, in four great Boards or Councils, viz.:— Governing Boards.

1. A Board of Administration, composed of the Commandant, the Second in Command, the Director of Studies, two Professors, two Captains, and two members of the Administrative Staff. This Board has the superintendence of all the financial business and all the minutiæ of the internal administration of the School. Board of Administration.

2. A Board of Discipline, consisting of the Second in Command, the Director, two Professors, three Captains (of the school), and two Captains of the army, chosen from former pupils. The duty of this Board is to decide upon cases of misconduct. Board of Discipline.

3. A Board of Instruction, whose members are, the Commandant, the Second in Command, the Director, the Examiners of Students, and the Professors; and whose chief duty is to make recommendations relating to ameliorations in the studies, the programs of admission and of instruction in the school, to— Board of Instruction.

4. A Board of Improvement, charged with the general control of the studies, formed of— Board of Improvement (*Conseil de Perfectionnement*).

The Commandant, as President.
The Second in Command.
The Director of Studies.
Two Delegates from the Department of Public Works.
One Delegate from the Naval Department.
One Delegate from the Home Department.
Three Delegates from the War Department.
Two Delegates from the Academy of Sciences.
Two Examiners of Students.
Three Professors of the School.*

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* *See* for other particulars on all these points the Decree in Appendix A. The members of the Board of Improvement, as given in the last Military Calendar (the *Annuaire Militaire* for 1856) are,—

Eblé, General of Brigade of Artillery, Commandant of the School, President.
Le Verrier, Member of the Academy of Sciences, and Senator.
Noizet, General of Division of Engineers.
Piobert, General of Division of Artillery, Member of the Academy of Sciences.
Morin, General of Division of Artillery, and Member of the Academy of Sciences.
Poncelet, General of Brigade of Engineers, and Member of the Academy of Sciences.
Mathieu, Rear Admiral.
Laisné, Director of Accounts in the Home Department, formerly pupil of the School.
Mary, Inspector of Roads and Bridges.
Michel Chevalier, Engineer-in-chief of Mines, Member of the Academy of Sciences.
Bodson de Noirfontaine, Colonel of Engineers, Second in Command in the School.
Riffault, Lieutenant-Colonel of Engineers, Director of Studies in the School.
Babinet, Cahours } Members of the Academy of Sciences } Examiners of Students.
Duhamel, Professor of Analysis, Member of the Academy of Sciences
Belanger, Engineer-in-chief of Roads and Bridges, Professor of Mechanics and machinery
Regnault, Professor of Chemistry, Member of the Academy of Sciences } Professors in the school.

III. *Conditions and Examinations for Admission.*

Conditions for admission to the Entrance Examination.

The Entrance Examination is held yearly in August; the most important conditions for admission to it are always inserted in the *Moniteur* early in the year, and are—

1st. All candidates must be Bachelors of Science.*

2nd. All candidates (unless they have served in the army) must have been as much as sixteen and not more than twenty years old on the 1st of January preceding.

3rd. Privates and Non-commissioned Officers of the army must be above twenty and under twenty-five years of age; must have served two years, and have certificates of good conduct.

4th. Candidates who propose to claim pecuniary assistance (a *bourse* or *demi-bourse*) must present formal proofs of their need of it.

Subjects.

The subjects of the Entrance Examination are the following:—

Arithmetic, including Vulgar and Decimal Fractions, Weights and Measures, Involution and Evolution; Simple Interest.

Geometry of Planes and Solids; application of Geometry to Surveying; Properties of Spherical Triangles.

Algebra, including Quadratic Equations with one unknown quantity, Series and Progressions in general; Binomial Theorem and its applications; Logarithms and their use; on Derived Functions; on the Theory of Equations; on Differences; application of the Theory of Differences to the Numerical Solution of Equations.

Plane and Spherical Trigonometry; Solution of Triangles; application of Trigonometry to Surveying.

Analytical Geometry, including Geometry of two dimensions; Co-ordinates; Equations of the first and second degree, with two variables; Tangents and Asymptotes; on the Ellipse, Hyperbola, and Parabola; Polar Co-ordinates; Curved Lines in general.

Geometry of three dimensions, including the Theory of Projections; Co-ordinates; the Right Line and Plane; Surfaces of the second degree; Conical and Cylindrical Surfaces.

Descriptive Geometry; Problems relative to a Point, Right line and Plane; Tangent Planes; Intersection of Surfaces.

Mechanics; on the Movement of a Point considered geometrically; on the Effect of Forces applied to points and bodies at rest and moving; on the Mechanical Powers.

Natural Philosophy, including the Equilibrium of Liquids and Gases; Heat; Electricity; Magnetism; Galvanism; Electro-magnetism and Light; Cosmography.

Chemistry, the Elements; *French; German; Drawing*, and (optionally) *Latin*.

The Examinations, the Preliminary and the Second, and the Written Compositions.

This Examination is partly written and partly oral. It is not public, but conducted in the following manner:—

Five Examiners are appointed by the Minister of War to examine the candidates at Paris, and at the several towns named for the purpose throughout France.

Two of these examiners conduct what may be called a Preliminary Examination (*du premier degré*), and the other three a Second Examination (*du second degré*). The preliminary examiners precede by a few days in their journey through France those who conduct the Second Examination. The written compositions come before either.

The Preliminary Examination (*du premier degré*) is made solely for the purpose of ascertaining whether the candidates possess sufficient knowledge to warrant their being admitted to the Second Examination; and the Second Examination serves, in conjunction with the written compositions, for their classification in the order of merit.

Previous exercises.

Prior to the examination, each candidate is called upon to give in certain written sheets containing calculations, sketches, plans, and drawings, executed by him at school during the year, certified and dated by the Professor under whom he has studied. Care is taken to ascertain whether these are the pupils' own work, and any deception in this matter, if discovered, excludes at once from the competition or the school.

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* The bachelor's degree is given in France at the end of a boy's school studies, and is a sort of certificate of his satisfactory completion of them. It is in arts or sciences, according to the course of studies which he has followed. Remarks on the point will be found further on, in the account of the *Lycées*.

The Written Compositions.

This done, the candidates are required to reply in writing to written or printed questions, and to write out French and German exercises; great care being taken to prevent copying. This written examination occupies about twenty-four hours during three and a half separate days, as shown in the following table. It usually takes place in the presence of certain official authorities, the examiners not being present.

First Sitting.	Hours.	*Second Sitting.*	Hours.
Arithmetic	1	Algebra	1
Geometry	1	History, geography, and French	3
Latin	1		
	3		4

Third Sitting.		*Fourth Sitting.*	
Descriptive geometry, and diagram or sketch	4	Mechanics	1
		Physics, chemistry, and cosmography	2
			3

Fifth Sitting.		*Sixth Sitting.*	
Applied analysis	1½		
German exercise	1½	Solution of a triangle by logarithms	3
	3		

Seventh Sitting.

Drawing - - - - 4 hours.

Total - - - - 24 hours.

The Preliminary Oral Examination.

Next, each candidate is examined orally for three-quarters of an hour, on two successive days, by each of the two examiners separately, and each examiner makes a note of the admissibility or non-admissibility of the candidate.

At the close of this oral examination, the notes relating to the various candidates are compared, and if the examiners differ as to the admissibility of any candidate, he is recalled, further orally examined, and his written exercises carefully referred to, both examiners being present. A final decision is then made.

Second Ora Examination.

The preliminary examiners then supply the others with a list of the candidates who are entitled to be admitted to the second oral Examination. On this occasion each candidate is separately examined for one hour and a half by each examiner, but care is taken that in all the principal subjects of study the candidate is examined by at least two out of the three examiners.

System of mark or credits.

Each examiner records his opinion of the merits of every candidate in replying, orally and in writing, by awarding him a credit varying between 0 and 20, the highest number indicating a very superior result.

This scale of merit is employed to express the value of the oral replies, written answers, or drawings. It has the following signification, and appears to be generally in use in the French military schools:—

20	denotes perfect.	8, 7, 6	denotes bad.
19, 18	„ very good.	5, 4, 3	„ very bad.
17, 16, 15	„ good.	2, 1	„ almost nothing.
14, 13, 12	„ passable.	0	„ nothing.
11, 10, 9	„ middling.		

Considerable latitude is granted to the examiner engaged in deciding upon the amount of credit to be allowed to the student, for the manner in which he replies to the various questions. He is expected to bear in mind the temperament of the candidate, his confidence or timidity, as well as the difficulty of the questions, when judging of the quality of the reply, more value being given for an imperfect answer to a difficult question than for a more perfect reply to an easy one.

Classification.

The Reports of the Examiners, together with the various documents belonging to each candidate, are sent from each town to the Minister at War, who transmits them to the Commandant of the Polytechnic School to make out a classified list.

Co-efficients of influence.

Very different value of course is attached to the importance of some of the subjects, when compared with others; and the measure of the importance is represented in French examinations by what are termed *co-efficients of influence*, varying for the several subjects of study and kind of examination. The particular co-efficients of influence for each subject in these written and oral examinations, are as follows:—

	Co-efficients of Influence.	
Oral examination—analytical mathematics	20	52
„ „ geometrical ditto	14	
„ „ physics and mechanics	16	
„ „ German language	2	
Written compositions on mathematical subjects	5	34
„ „ descriptive geometry, drawing, and description	5	
„ „ logarithmic calculations of a triangle	2	
„ „ mechanics	2	
„ „ physics or chemistry	4	
German exercise	1	
French composition	5	
Latin translation	5	
Copy of a drawing	5	
Total		86

In order to make out the above-mentioned classified list, the respective credits awarded by the examiners to each candidate are multiplied by the co-efficients representing the weight or importance attached to each subject; and the sum of their products furnishes a numerical result, representing the degree of merit of each candidate.

A comparison of these numerical results is then made, and a general list of all the candidates is arranged in order of merit.

The Jury.

This list, and the whole of the documents from which it has been drawn up, are then submitted to a jury composed of the

Commandant of the School.
The Second in command.
The Director of Studies.
Two Members of the Board of Improvement.
The Five Examiners.

It is the special business of this jury carefully to scrutinize the whole of the candidates' documents, drawings, &c., and they further take care that a failure in any one branch of study is duly noted, as such failure is a sufficient reason for the exclusion of the candidate from the general list.*

Report made to the Minister of War.

As soon as this general list has been thoroughly verified, it is submitted to the Minister of War, who is empowered to add one tenth to the number actually required for the public services; and thus it may happen that one tenth of the pupils may annually be disappointed.

IV. *The School Buildings and the Course and Method of Study.*

The Buildings, which include the residence of the Commandant and Director of Studies.

A brief description of the buildings may be a suitable introduction to an account of the studies that are pursued, and the life that is led in them.

* There appears to be reason, however, for thinking that this regulation is not very rigorously carried into effect, so that a failure in one or more subjects of study does not finally exclude if the candidate be very well grounded in the principal subjects of study.

The Polytechnic School stands near the Pantheon, and consists of two main buildings, one for the official rooms and the residence of the Commandant and Director of Studies, the other, and larger one, for the pupils. Detached buildings contain the chemical lecture room and laboratory, the laboratory of natural philosophy, the library, fencing and billiard rooms.

The Refectories, Lecture-rooms, and Museums.

The basement floor of the larger building contains the kitchen and refectories. On the first floor, are the two amphitheatres or great lecture rooms, assigned respectively to the pupils of the two years or divisions, in which the ordinary lectures are given. The rooms are large and well arranged; the seats fixed, the students' names attached to them. The students are admitted by doors behind the upper tier of seats; at the foot of all is a platform for the Professor, with a black-board facing his audience, and with sufficient room for a pupil to stand and work questions beside him. Room also is provided for one of the captains, inspectors of studies, whose duty it is to be present, for the Director of Studies, whose occasional presence is expected, and for the Assistant Teachers or *répétiteurs*, who in the first year of their appointment are called upon to attend the course upon which they will have to give their subsequent questions and explanations. On this floor are also the museums, or repositories of models, instruments, machines, &c., needed for use in the amphitheatres, or elsewhere. The museum provided for the lecturer on Physics (or Natural Philosophy) appeared in particular to be well supplied.

The *Salles d'interrogation.*

The whole of the second floor is taken up with what are called the *salles d'interrogation*, a long series of small cabinets or studies, plainly furnished with six or eight stools and a table, devoted to the *interrogations particulières*, which will presently be described.

The *Salles d'étude*, (halls of study, or studying-rooms.)

The third floor contains the halls of study, *salles d'étude*, or studying rooms, in which the greater part of the student's time during the day is passed—where he studies, draws, keeps his papers and instruments, writes his exercises, and prepares his lectures. These are small chambers, containing eight or, exceptionally, eleven occupants. A double desk runs down the middle from the window to the door, with a little shelf and drawers for each student. There is a black-board for the common use, and various objects are furnished through the senior student, the sergeant, a selected pupil, more advanced than the rest, who is placed in charge of the room, and is responsible for whatever is handed in for the use of the students. He collects the exercises, and generally gives a great deal of assistance to the less proficient. "When I was sergeant," said an old pupil, "I was always at the board." The spirit of *camaraderie*, said to exist so strongly among the Polytechnic students, displays itself in this particular form very beneficially. Young men of all classes work heartily and zealously together in the *Salles d'étude*, and no feeling of rivalry prevents them from assisting one another. The sergeant does not, however, appear to exercise any authority in the way of keeping discipline.

These chambers for study are arranged on each side of a long corridor which runs through the whole length of the building, those of the juniors being separated from those of the seniors by a central chamber or compartment, the *cabinet de service*, where the officers charged with the discipline are posted, and from hence pass up and down the corridor, looking in through the glass doors and seeing that no interruption to order takes place.

The Dormitories.

The fourth story is that of the dormitories, airy rooms, with twelve beds in each. These rooms are arranged as below, along the two sides of a corridor, and divided in the same manner into the senior and junior side. A non-commissioned officer is lodged at each end of the corridor to see that order is kept.

Course of study.

Such is the building into which at the beginning of November the successful candidates from the *Lycées* and the *Ecoles préparatoires* are introduced, in age resembling the pupils whom the highest classes of English public schools send annually to the Universities, and in number equal perhaps to the new undergraduates at one of the largest Colleges at Cambridge. There is not, however, in other points much that is common, least of all in the methods and habits of study we are about to describe. This will be best understood by a summary of a day's work.*

Daily routine.

The students are summoned to rise at half-past five, have to answer the roll-call at six, from six to eight are to occupy themselves in study, and at

* *See* also a Table of the Distribution of Time in Appendix D.

The Morning Lecture of an hour and a half,

eight they go to breakfast. On any morning except Wednesday, at half-past eight, we should find the whole of the new admission assembled in an amphitheatre, permanent seats in which are assigned to them by lot, and thus placed they receive a lecture from a professor, rough notes of which they are expected to take while it goes on. The first half hour of the hour and a half assigned to each lecture is occupied with questions put by the professor relating to the previous lecture. A name is drawn by lot, the student on whom the lot falls is called up to the black board at which the professor stands, and is required to work a problem and answer questions. The lecture concluded, the pupils are conducted to the *salles d'étude*, which have just been described, where they are to study. Here for one hour they devote themselves to completing and writing out in full the notes of the lecture they have just heard. The professor and his assistants, the *répétiteurs*, are expected to follow and make a circuit through the corridors, to give an opportunity to ask for information on any difficult points in the lecture. A lithographed summary of the substance of the lecture, extending perhaps to two octavo pages, is also furnished to each studying room for the use of its pupils.

followed by an hour of study on the subject of the lecture.

Travaux Graphiques for three hours.

The lecture, as we have said, commences at half-past eight o'clock; it lasts an hour and a half; the hour of writing up the notes brings us to eleven. The young men are now relieved by a change of occupation, and employ themselves (still in their places in the rooms of study) at drawing. A certain number, detached from the rest, are sent to the physical and chemical laboratories. The rotation is such as to admit each student once a month to two or three hours' work at a furnace for chemistry, and once in two months to make experiments in electricity, or other similar subjects. In this way, either at their drawing or in the laboratories, they spend three hours, and at two o'clock go to their dinner in the refectories below, and after dinner are free to amuse themselves in the court-yard, the library, the fencing and the billiard rooms, till five. At five they return to the studying-rooms, and for two hours, on Mondays and Fridays, they may employ themselves on any work they please (*étude libre*); on Tuesday there is a lecture in French literature, and on Thursday in German; at seven o'clock they commence a lesson, which lasts till nine, in landscape and figure drawing, or they do exercises in French writing or in German; at nine they go down to supper; at half-past nine they have to answer to a roll-call in their bedrooms, and at ten all the lights are put out.

Dinner, recreation, and evening occupations.

Wednesday is a half-holiday, and the pupils are allowed to leave the school after two o'clock, and be absent till ten at night. The morning is occupied either in study, at the pleasure of the students, or in set exercises till eleven, when there is a lecture of one hour and a half, followed, as usual, by an hour of special study on the subject of the lecture. On Sunday they are allowed to be absent almost the whole day till ten p.m. There is no chapel, and apparently no common religious observance of any kind in the school.

Total amount of study *per diem*.

Such is a general sketch of the ordinary employment of the day; a couple of hours of preparatory study before breakfast, a lecture on the differential calculus, on descriptive geometry, on chemistry, or natural philosophy, followed by an hour's work at notes; scientific drawing till dinner; recreation; and general study, or some lighter lecture in the evening. Were we merely to count the hours, we should find a result of eleven or eleven and a half hours of work for every day but Wednesday, and of seven and a half hours for that day. It is to be presumed, however, that though absolute idleness, sleeping, or reading any book not authorized for purposes of study, is strictly prohibited, and when detected, punished, nevertheless the strain on the attention during the hours of drawing and the lectures of the evening is by no means extreme. Landscape and figure drawing, the lecture in French literature, and probably that in German, may fairly be regarded as something like recreation. Such, at least, was the account given us of the lectures on literary subjects, and it agrees with the indifference to literature which marks the school. Of wholesome out-of-door recreation, there certainly seems to be a considerable want. There is nothing either of the English love of games, or of the skilful athletic gymnastics of the German schools.

The method of teaching is peculiar.

The method of teaching is peculiar. The plan by which a vast number of students are collected as auditors of professorial lectures is one pursued in many academical institutions, at the Scotch Universities, and in Germany. Large classes attend the lectures in Greek, in Latin, and in mathematics at Glasgow;

they listen to the professor's explanations, take notes, are occasionally questioned, and do all the harder work in their private lodgings. Such a system of course deserves in the fullest sense the epithet of voluntary; a diligent student may make much of it; but there is nothing to compel an idle one to give any attention.

Its professorial character.

It seems to have been one especial object pursued in the Polytechnic to give to this plan of instruction, so lax in itself, the utmost possible stringency, and to accumulate upon it every attainable subsidiary appliance, every available safeguard against idleness. Questions are expressly put *vivâ voce* by the professor before his lecture; there is a subsequent hour of study devoted to the subject; there is the opportunity for explanation to individual students; the exaction of notes written out in full form; the professor also gives exercises to the students to write during their hours of general study, which he examines, and marks; general vivâ voce examinations (*interrogations générales*), conducted by the professors and *répétiteurs*, follow the termination of each course of lectures; and lastly, one of the most important and peculiar parts of the method, we have what are called the *interrogations particulières*. After every five or six lectures in each subject, each student is called up for special questioning by one of the *répétiteurs*. The rooms in which these continual examinations are held have been described. They occupy one entire story of the building; each holds about six or eight pupils, with the *répétiteurs*. Every evening, except Wednesday, they are filled with these little classes, and busy with these close and personal questionings. A brief notice, at the utmost of twenty-four hours, is served upon the students who are thus to be called up. Generally, after they have had a certain number of lectures, they may expect that their time is at hand, but the precise hour of the summons cannot be counted upon. The scheme is continually varied, and it defies, we are told, the efforts of the ablest young analysts to detect the law which it follows.

How modified.

Questions.

Exercises and continual examinations.

It will be seen at once that such a system, where, though nominally professorial, so little is left to the students' own voluntary action, where the ordinary study and *reading*, as it is called in our English Universities (here such an expression is unknown) is subjected to such unceasing superintendence and surveillance, and to so much careful assistance, requires an immense staff of teachers. At the Polytechnic, for a maximum of 350 pupils, a body of fifteen professors and twenty-four *répétiteurs*, are employed, all solely in actual instruction, and in no way burdened with any part of the charge of the discipline or the finance, or even with the great yearly examinations for the passage from the first to the second division, and for the entrance to the public services.

The repetitorial system of numerous assistant teachers and highly qualified professors.

With a provision of one instructor to every eight students, it is probable that in England we should avoid any system of large classes, from the fear of the inferior pupils being unable to keep pace with the more advanced. We should have numerous small classes, and should endeavour, above all things, to obtain the advantage of equality of attainment in the pupils composing them.

The French, on the other hand, make it their first object to secure one able principal teacher in each subject, a professor whom they burden with very few lectures. And to meet the educational difficulty thus created, to keep the whole large class of listeners up to the prescribed point, they call in this numerous and busily employed corps of assistants to *repeat*, to go over the professor's work afresh, to whip in, as it were, the stragglers and hurry up the loiterers. Certainly, one would think, a difficult task with a class of 170 freshmen in such work as the integral and differential calculus. It is one, however, in which they are aided by a stimulus which evidently acts most powerfully on the students of the Polytechnic School. During the two years of their stay, the prospect of their final admission to the public services can rarely be absent from the thoughts even of the least energetic and forethinking of the young men. Upon their place in the last class list will depend their fortune for life. A high position will secure them not only reputation, but the certainty of lucrative employment; will put it in their power to select which service they please, and in whichever they choose will secure them favourable notice. Let it be remembered that 53 of these 170 are free scholars, born of parents too poor to pay 40*l.* a year for their instruction, to whom industry must be at all times a necessity, and industry during their two years at the Polytechnic the best conceivable expenditure, the most certainly remunerative investment of their pains and labour. The place on the final class list is obviously the prize for which this race of two years' length has to be run. What is it determines that place? Not by any means a final

Stimulus of the system of marks or credits.

struggle before the winning-post, but steady effort and diligence from first to last throughout the course. For the order of the class list is not solely determined by success in the examination after which it is drawn up, but by the result of previous trials and previous work during the whole stay at the school.

These are given for all the work done in the two years, and count in the last examination.

For, during the whole time, every written exercise set by the professor, every drawing, the result of every *interrogation particulière* by the *répétiteurs*, and of each general interrogation by the professors and *répétiteurs*, is carefully marked, and a credit placed accordingly to the name of the student, and reserved for his benefit in the last general account. The marks obtained in the examination which closes the first year of study form a large element in this last calculation. It had been found that the work of the first year was often neglected: the evil was quickly remedied by this expedient. The student, it would seem, must feel that he is gaining or losing in his banking account, so to call it, by every day's work; every portion of his studies will tell directly for or against him in the final competition, upon which so much depends.

Such is the powerful mechanism by which the French nation forces out of the mass of boys attending their ordinary schools the talent and the science which they need for their civil and military services. The efforts made for admission to this great scientific school of the public services, the struggle for the first places at the exit from it, must be more than enough, it is thought, to establish the habits of hard work, to accumulate the information and attainment, and almost to create the ability which the nation requires for the general good.

Courses of the two years. The First Year's Course.

We may now follow the student through his course of two years' study. The first year's work may be mainly divided into three portions of unequal length; two of them of about four months each (with an additional fortnight of private study and examination), are mainly given to hard lecturing, whilst the third portion of two months is devoted to private study and to the examinations.

In accordance with this arrangement of the year, the four hardest subjects are thus distributed. Analysis and descriptive geometry, the staple work of the school,—its Latin, as M. de Barante called it,—come in the first four months; there is then a pause for private study and a general examination in these two subjects (*interrogations générales* as distinct from the *interrogations particulières* of the *répétiteurs*). This brings us to the middle of March. Analysis and geometry are then laid aside for the rest of the year, and for the next portion of four months the pupils work at mechanics and geodesy, private study and a general examination completing this course also. Important lectures on physics and chemistry run on during both these periods, and are similarly closed by private study and a general examination. The less telling evening classes of French literature and German end at the beginning of June, and landscape and figure drawing only last half the year. It may be observed also, that, as a general rule, there is on each day one, and only one, really difficult lecture. This is immediately preceded and followed by private study, but then comes something lighter, as a relief, such as drawing or work in the laboratories.

The chief feature in the third portion of the year is the complete break in the lectures for general private study (*étude libre*),—a month or six weeks before the closing examination at the end of the year. The immediate prospect of this prevents any undue relaxing of the work; and it is curious to observe here how private efforts and enforced system are combined together, for even the private efforts are thus systematised and directed. The closing examination of the first year begins on the 1st and ends on the 25th of September.

The total number of lectures in each branch of study, with the dates when they respectively commence and finish, and the period when the general examinations (*interrogations générales*) take place, are exhibited in the following Tables, and we should add that the interval between the close of each course and the commencement of the chief yearly examination is devoted to free study.

TABLE for the Second or Lower Division, following the First Year's Course of Study.

Subject of Study.	Number of Lectures.	Course of Lectures.		General Examinations. *Interrogations Générales.*		Annual Examination.
		Commenced.	Finished.	Commenced.	Finished.	
Analysis - - -	48	3rd November.	25th February.	13th March.	18th March.	Begins on
Mechanics and Machines -	40	21st March.	29th June.	24th July.	2nd August.	the
Descriptive Geometry -	38	3rd November.	3rd March.	13th March.	18th March.	1st Sept.,
Physics - - -	34	2nd „	28th June.	10th July.	19th July.	and ends
Chemistry - - -	38	5th „	17th „	10th „	19th „	on the
Geodesy - - -	35	20th March.	30th „	24th „	2nd August.	25th Sept.
French Literature - -	30	8th November.	6th „	—	—	—
German - - -	30	2nd „	15th „	—	—	—
Figure and Landscape Drawing	50	4th „	28th April.	—	—	—
Total - - -	343					

The work of the second year is almost identical in its general plan with that of the first. A continuation of analysis with mechanics in place of descriptive geometry is the work of the first four months, then comes the private study and the *interrogations générales*, and then again, from the middle of March to the middle of July, work of a more professional character, stereotomy, the art of war and topography, forms the natural completion of the pupil's studies. Chemistry and physics follow the same course as during the first year, and terminate with the private study and the general examination at the beginning of August. The evening lectures in French literature and German end about the middle of June, and those in figure and landscape drawing at the beginning of May. The last portion is again given to private study and the great Final Examination. The Second Year's Course.

TABLE for the First or Upper Division, following the Second Year's Course of Study.

Subject of Study.	Number of Lectures.	Course of Lectures.		General Examinations. *Interrogations Générales.*		Annual Examination.
		Commenced.	Finished.	Commenced.	Finished.	
Analysis - - -	32	11th November.	3rd March.	13th March.	18th March.	Begins on
Mechanics and Machines -	42	10th „	2nd „	13th „	18th „	the
Stereotomy - - -	32	20th March.	26th June.	10th July.	19th July.	10th Sept.,
Physics - - -	36	12th November.	29th „	24th „	2nd August.	and ends
Chemistry - - -	38	14th „	28th „	24th July.	2nd „	on the
Architecture and Construction	40	10th „	8th „	—	—	10th Oct.
Military Art and Fortification	20	21st March.	21st „	10th „	19th July.	—
Topography - - -	10	3rd January.				
French Literature - -	30	11th November.	9th „	—	—	—
German - - -	30	14th „	19th „	—	—	—
Figure and Landscape Drawing	48	12th „	2nd May.	—	—	—
Total - - -	358					

V. *The Examinations, particularly that of the First Year and the Final One.*

We have now brought the pupil nearly to the end of his career, but must previously say a few words about his examinations, the chief epochs which mark his progress, and the last of which fixes his position almost for life. For this purpose it is necessary to recapitulate briefly what has been said in different places of the whole examinatorial system of the Polytechnic School. Recapitulation of the minor examinations or interrogations.

Questions.

1. All the professors require the students in their studying rooms, to answer questions in writing on the courses as they go through them: a different question is given to each student, and every third question is of such a nature as to involve a numerical example in the reply.

These questions are given in the proportion of one to about every four lectures, and the replies, after being examined by the professor or *répétiteur*, are endorsed with a credit, varying from 0 to 20, and the paper is then given back to the student, to be produced at the close of the year.

Manipulations.

2. Credits are assigned to the students for their ordinary manipulations in chemistry and physics, during the first year; and at the close of each year, for their manipulations, in chemistry alone, before the Examiners.

Examinations by the *répétiteurs*.

3. The *répétiteurs* examine, (in the *interrogations particulières*,) every ten or fourteen days, from six to eight students during a sitting of two hours, on the subject of study lectured on since the previous examination of the same kind. All these students must continue present, and at the close the *répétiteur* assigns to each a credit entirely dependent on the manner in which each has replied. The Professors and Captains Inspectors are occasionally present at these examinations, which are discontinued at certain periods according to the instructions of the Director of Studies.

General Examinations.

4. At different intervals of time, from a fortnight to a month, as may happen, after the close of the course in each branch of study, general examinations (*interrogations générales*) are made by the professors and *répétiteurs*. From four to six students are examined together for at least two hours, and at the conclusion the professor makes known to the Director of Studies the credit he has granted to each student for the manner in which he has passed his examination.

The two great Annual Examinations.

Such may be called the minor or ordinary examinations. But there is an annual closing examination at the end of each year, which we will now describe. The First Year's Annual Examination commences on the 1st and ends on the 25th September. It is carried on by special Examiners (a different set from those who conduct the entrance examinations), and not by the Professors. These give to every student a credit between 0 and 20 in each branch of study, according to the manner in which he replies.

The Examination at the close of the First Year.

Use of the co-efficients of influence in this examination.

The following Table shews the co-efficients of influence allowed to the different studies of the first year, subdivided also among the particular classes of examination to which the student has been subjected. The component parts of the co-efficients, as well as the co-efficients themselves, slightly vary from year to year, dependent on the number of examinations:—

TABLE I.—First Year's Course of Studies: Second Division.

Nature of Study.	Total Co-efficients.	Co-efficient of Influence awarded to								
		Written Answers to Professors' Questions.	Examinations by *Répétiteurs.* (*Int. Part.*)	General Examinations. (*Int. Gén.*)	Manipulations.		Sheets of notes on descriptive Geometry.	Graphical Representations and Drawing.	First Annual Examination.	Total Co-efficients.
					Ordinary.	At Examinations.				
Analysis	56	9	10	9	-	-	-	-	28	56
Mechanics	60	7	9	8	-	-	-	14	22	60
Descriptive Geometry	48	-	7	7	-	-	4	12	18	48
Geodesy	39	6	5	7	-	-	-	3	18	39
Physics	45	6	9	7	2	-	-	-	21	45
Chemistry	45	5	9	7	4	2	-	-	18	45
French Literature	12	12	-	-	-	-	-	-	-	12
German Language	10	2	3	-	-	-	-	-	5	10
Drawing	10	-	-	-	-	-	-	10	-	10
Shading and Tinting Plans	3	-	-	-	-	-	-	3	-	3

At the conclusion of this Examination the Director of Studies prepares a statement for each student, exhibiting the credits he has obtained at each of the preceding examinations in each subject, multiplied by the co-efficient of influence, and the sum of the products represents the numerical amount of the student's credit in each branch of study.

As the process is somewhat intricate, we append the following example, to show the nature of the calculation performed in order to ascertain the amount of credits due to each student:—

Report of the Credits gained in the First Year's Course of Study by by M. N., Student at the Polytechnic School.

Subject of Examination.	Co-efficient of Influence.	Nature of Examination or Proof.	Credit obtained by the Student.	Co-efficient of Influence.	Product.	Sum of Products.	Mean Credit in each Subject of the Course.
Analysis	56	Written answers to Professors' questions.	17·16	9	154·44	845·81	15·09
		Examinations by *répétiteurs* (*interrogations particulières*).	15·47	10	154·70		
		General examination (*interrogations générales*).	13·71	9	123·39		
		Annual examination	14·76	28	413·28		
Mechanics	60	Written answers to Professors' questions	13·45	7	94·15	664·13	11·07
		Examinations by *répétiteurs*	12·72	9	114·48		
		General examination	11·37	8	90·96		
		Graphical representations and drawing.	5·61	14	78·54		
		Annual examination	13·00	22	286·00		
Descriptive Geometry	48	Examinations by *répétiteurs*	17·15	7	120·05	633·15	13·19
		General examination	11·72	7	82·04		
		Sheets of notes	12·45	4	49·80		
		Graphical representations and drawing.	11·88	12	142·76		
		Annual examination	13·25	18	238·50		
Geodesy	39	Written answers to Professors' questions.	9·16	6	54·96	229·01	5·87
		Examinations by *répétiteurs*	7·85	5	39·25		
		General examination	5·74	7	40·18		
		Graphical representations and drawing.	4·36	3	13·08		
		Annual examination	4·53	1	81·54		
Physics	45	Written answers to Professors' questions.	2·76	6	16·56	112·21	2·49
		Examinations by *répétiteurs*	3·54	9	31·86		
		General examination	3·15	7	22·05		
		Ordinary manipulation	1·55	2	3·10		
		Annual examination	1·84	21	38·84		
Chemistry	45	Written answers to Professors' questions.	2·46	5	12·30	131·16	2·91
		Examinations by *répétiteurs*	3·25	9	29·95		
		General examination	2·47	7	17·29		
		Ordinary manipulation	2·26	4	9·04		
		Manipulation at examination.	1·58	2	3·16		
		Annual examination	3·34	18	60·12		
French Literature	12	Written answers to Professors' questions.	5·64	12	67·68	67·68	5·64
German Language	10	Written answers to Professors' questions.	6·57	2	13·14	55·92	5·59
		Examinations by *répétiteurs*	4·86	3	14·58		
		Annual examination	5·64	5	28·20		
Drawing	10	Graphical representations and drawing.	4·36	10	43·60	43·60	4·36
Shading and Tinting Plans	3	Graphical representations and drawing.	3·86	3	11·58	11·58	3·86

Sum = 10)70·07

General Mean Credit = (7·00)

It is important to remark that any student whose *mean credit*, given in the eighth column of the preceding table, in any branch of study does not exceed *three*, or whose *general mean credit* for the whole of the studies being the arithmetical mean of all the values recorded in the eighth column, and given at the bottom in the example, does not exceed *six*, is *considered to possess an insufficient amount of instruction to warrant his being permitted to pass into the first division for the second year's course.* He is accordingly excluded from the school,* unless he has been prevented from pursuing his studies by illness, in which case, when the facts are thoroughly established, he will be allowed a second year's study in the second division, comprising the first year's course of study.

The Final Examination at the close of the Second Year.

We now pass to the Second Annual or great Final Examination for Admission to the Public Services, remarking only that in the *interrogations générales* of the second year the principal subjects of both years are included.

The Final Examinations for Admission into the Public Service commence about the 10th September, and last about one month. They are conducted by the same Examiners who examined at the close of the first year. These are five in number, and appointed by the Minister of War. One of these takes analysis; a second, mechanics; a third, descriptive geometry and geodesy; the fourth, physics; and the fifth, chemistry.

The examination in military art and topography is conducted by a Captain of Engineers specially appointed for the purpose; and in the same manner the examination in German is carried on by a professor, usually a civilian, specially but not permanently appointed.

The questions are oral, and extend over the whole course of study pursued during the two years. Each student is taken separately for one hour and a quarter on different days by each of the five Examiners; each Examiner examines about eight students daily.

Use of the co-efficients of influence.

A table, very similar to that already given, is prepared under the superintendence of the Director of Studies for every student, to ascertain the numerical amount of his credits in each branch of study, the co-efficients of influences for the particular subject of study and nature of examination being extracted from a table similar to that in page 23, and when these tables have all been completed, a general list of all the students is made out, arranged in the order of their merits.

Formerly, conduct was permitted to exercise some slight influence on their position, but that is no longer the case.

The same regulations exist, as regards the minimum amount of credit that will entitle the students to enter into the public service, as have already been stated above in reference to the passage from the 1st to the 2nd year's course of study.

TABLE II.— Second Year's Course of Study: First Division.

	Total Co-efficients.	Co-efficient of Influence awarded to										
		Result of previous Year's Examination.	Written Answers to Professors' Questions.	Examinations by *Répétiteurs.* (*Int. Part.*)	General Examinations. (*Int. Gén.*)	Manipulation. Ordinary.	Manipulation. At Examinations.	Sketches and Notes in Architecture.	Graphical Representations and Drawing.	Examination in Architecture.	Second Annual or Final Examination.	Total Co-efficients.
Analysis	81	28	8	10	9	-	-	-	-	-	26	81
Mechanics	92	25	8	12	9	-	-	-	10	-	28	92
Descriptive Geometry	36	36	-	-	-	-	-	-	-	-	-	36
Geodesy†	37	-	6	5	7	-	-	-	1	-	18	37
Physics	68	23	5	10	8	-	-	-	-	-	22	68
Chemistry	68	20	5	10	8	4	2	-	-	-	19	68
Architecture	36	-	-	-	-	-	-	12	14	10	-	36
Military Art and Topography	25	-	-	3	5	-	-	-	9	-	8	25
French Literature	18	6	12	-	-	-	-	-	-	-	-	18
German	15	5	2	3	-	-	-	-	-	-	-	15
Drawing	15	5	-	-	-	-	-	-	10	-	-	15
Shading and Tinting	5	2	-	-	-	-	-	-	3	-	-	5

Remarks on the system of examinations.

From the preceding tables and explanations, it will be apparent that, as the whole of the students for each year are compelled to follow precisely the same

* We were unable to ascertain positively whether or not this rule is strictly carried out as regards the exclusion from the school, in consequence of a failure in German, French, or Drawing, when the student exhibits superior qualifications in the principal branches of study.

† Geodesy is sometimes taught in the second and not in the first year's course.

course of study, the system of professorial instruction, combined with the constant tutelage and supervision exercised by the *répétiteurs*, and the examinations (*interrogations particulières*) of the *répétiteurs*, at short intervals of time, have for their principal object the keeping alive in the minds of the students the information which has been communicated to them. As a stimulus to continuous and unceasing exertion, it will be seen by an inspection of the Tables of the co-efficients of influence, that the manner in which the students acquit themselves from day to day and from week to week is made an element, and a very important one, in determining their final position in the list arranged according to merit, exceeding as it does in most instances the influence exerted on their classification by their final examination at the close of each year. This principle thus recognizes not only their knowledge at the end of each year, but also the manner in which they have proved it to the Professors and *répétiteurs* in the course of the year; and with reference to the second year's study, the final result of the first year's classification exercises an influence amounting to about one-third of the whole, in the final classification at the end of the second year.

It follows also, that as the examinations at the end of each year are made by Examiners, otherwise unconnected with the School, and not by the Professors belonging to it, the positions of the students in the classified list is partly dependent on the judgment of the Professors with whom they are constantly in communication, and partly on the public Examiners, whom they meet only in the examination rooms.*

The Examiners of the Students are not frequently changed, and practically the same may be said of the Examiners for Admission.

Preference given by the students to the Civil Services.

The students at the head of the list have generally since the wars of the first Empire entered into the civil rather than into the military services, the former being much better remunerated.

The services are usually selected by preference, nearly in the following order:—

The Roads and Bridges (*Ponts et chaussées*) and Mines (*Mines*) } very nearly on an equality.
Powder and Saltpetre (*Poudres et Salpêtres*).
Naval Architects (*Génie maritime*).
Engineers (*Génie militaire*).
The Artillery (*Artillerie de terre*) and the Staff Corps (*Etat Major*) } very nearly on an equality.
The Hydrographical Corps (*Ingénieurs Hydrographes*).
Tobacco Department (*Administration des Tabacs*).
Telegraph Department (*Lignes Télégraphiques*).
Navy (*Marine*).
Marine Artillery (*Artillerie de mer*).

Such, at least, is the result of a comparison of the selections made by the students during eight different years.†

* The influence exercised in the various branches of study, and consequently in the position of the students in the list classified according to merit, by the professors and *répétiteurs* on the one hand, and by the examiners on the other, is as follows:—

Subjects of Study.	Per-centage of influence exercised on the position of the Students.						
	During the 1st Year.		During the 2nd Year.			In the Classified List at the end of 2nd Year.	
	By Professors and *Répétiteurs.*	By Examiners.	By the results of the 1st Year's Examination.	By Professors and *Répétiteurs.*	By Examiners.	By Professors and *Répétiteurs.*	By Examiners.
Analysis	50·0	50·0	34·5	32·5	33·0	49·75	50·25
Mechanics	63·2	36·7	27·2	42·4	30·4	59·6	40·40
Descriptive Geometry	62·5	37·5	100·0	0·0	0·0	62·5	37·5
Geodesy	53·8	46·2	0·0	51·4	48·6	*51·4	48·6
Physics	53·3	46·7	33·8	33·8	32·4	51·8	48·2
Chemistry	60·0	40·0	29·4	43·2	27·4	60·8	39·2
Architecture	- - -	- -	0·0	100·0	0·0	100·0	100·0
Military Art and Topography.	- - -	- -	0·0	68·0	32·0	68·0	32·0
French Literature	100·0	0·0	33·3	66·7	0·0	100·0	0·0
German Language	100·0	0·0	33·3	33·3	33·4	66·7	33·3
Drawing	100·0	0·0	33·3	66·7	0·0	100·0	0·0
Shading and Tinting Plans.	100·0	0·0	40·0	60·0	0·0 *	100·0 * When taught in the 2nd year.	0·0

† See for further details the Tables given in the Appendix.

Complaints on the part of military authorities.

This preference of the civil to the military services has been the subject of frequent complaints on the part of the military authorities to the Minister of War. Thus the report of General Paixhans, after the inspection of the School of Application for the Artillery and Engineers at Metz in 1846, states:—

Remarks by General Paixhans.

"*L'enseignement des professeurs est fort, et l'instruction des élèves est faible,* "*tellement faible, que la valeur de cette instruction, qui s'exprime, pour chaque* "*élève, depuis le chiffre* un, *qui est celui des très-mauvais, jusqu'au chiffre* vingt, "*qui est celui des très bons, n'est que de* douze *pour la promotion, sortant cette* "*année* (*qui n'est point une promotion inférieure aux précédentes*), *et que l'on* "*a été obligé d'établir la règle de recevoir comme suffisamment instruit, tout* "*élève qui ne descendrait pas au chiffre* sept."

"*La principale cause de la faible instruction est l'infériorité qui résulte du* "*mode actuel de recrutement de l'Ecole de Metz par l'Ecole Polytechnique,* "*recrutement qui constitue la médiocrité dans les deux armes de l'Artillerie et* "*du Génie, en ne leur accordant que ceux des élèves de l'Ecole Polytechnique* "*qui n'ont pu obtenir les emplois civils. On a vu, en* 1842, *le* 1er *élève du Génie* "*n'être que le* 55e *de l'Ecole Polytechnique; en* 1844, *le* 1er *élève de l'Artillerie* "*n'être que le* 65e *de l'Ecole Polytechnique; et, en* 1842, *le* 1er *élève de l'Artillerie* "*de Marine n'être que le* 117e*; abaissement de la carrière militaire non moins* "*nuisible a l'intérêt général que ne l'a été antérieurement sa prédominance* "*exclusive. Ce n'est point avec des queues de promotion qu'on forme le corps,* "*et surtout la tête de deux armes qui ont besoin d'hommes choisis; et il est* "*déplorable de voir qu'on n'arrive plus à l'honneur de commander à des troupes* "*d'élite, autrement qu'à titre de condamné. M. le Maréchal Soult, Président* "*du Conseil, avait reconnu le mal; il écrivait* (*le* 13 *Janvier* 1841) *au* "*commandant de l'Ecole d'Application, qu'il ferait un examen attentif de la* "*question d'attirer vers les services d'Artillerie et du Génie des sujets plus* "*distingués de l'Ecole Polytechnique.*"

From the information supplied to us, and given at length in the Appendix*, we are enabled to state that the same preference of the civil to the military services, complained of by General Paixhans in 1846, remains nearly as at that time, and the value of the knowledge exacted from the students at the bottom of the classified list remains much the same as when General Paixhans wrote.

No steps have, however, been taken by the French Government to prevent the *free* choice of a profession being granted to the most successful students.

We have now followed the student at the Polytechnic to the end of his school career. He is then to pass to his particular School of Application, in which (as the name implies) he is taught to apply his science to practice. It is difficult to state precisely the amount of such science which the highest pupils may be thought to possess on leaving; the best idea of it will be gained by reference to the Programmes of the most important of the Lectures printed among the Appendices to this volume. It is also needless to dwell again on the main features of the School—the emulation called forth, the minute method, the great prizes offered for sustained labour. We must, however, make some remarks on these points before concluding our account, so far as they bear on the subject of military education.

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* *See*, for a Table of the selections made by the Students, Appendix D, and for the marks obtained, Appendix E.

VI. *General Remarks.*

1. Keeping out of sight for the moment some defects both in the principles and details of the education of this school, the method of teaching adopted seems to us excellent, and worthy of careful study. In this remark we allude principally to the skilful combination of two methods which have been generally thought incompatible; for it unites the well prepared lecture of a German professor, with the close personal questioning of a first-rate English school or college lecture. But besides this, its whole system is admirably adapted for the class of pupils it educates.

General excellence of the system of teaching.

See the Evidence in pages 46, 48.

These pupils are generally not of the wealthy classes; they are able, and struggling for a position in life. On all these grounds their own assistance in the work may be calculated upon. Yet they are not left to themselves to make the most of their professors' lectures. The aid of *répétiteurs*, even more valuable in its constant "prudent interrogations," than in the explanations afforded, is joined to the stimulus given by marking every step of proficiency, and by making all tell on the last general account. But though the routine and method of the school are so elaborate, play is given to the individual freedom of the pupils in their private work, and this is managed so skilfully that the private work is made immediately to precede the final examination, on which mainly depends the pupil's place for life. Thus from first to last they are carried on by their system without being cramped by it; every circumstance favourable to study is made the most of; rigorous habit, mental readiness, the power of working with others, and the power of working for themselves, the ambition for immediate and permanent success, all the objects and all the methods which students ever have in view, support and stimulate those of the Polytechnic in their two years' career.

2. The mainspring, however, of the school's energy is the competition amongst the pupils themselves, and this could hardly exist without the great prizes offered to the successful. This advantage, added to the general impulse of the early days of the Empire, has no doubt powerfully contributed to the great position of the school. It has made it a kind of university of *élite* mathematicians, and as in England young men look to the prizes of the Universities, and the professions to which they lead, as their best opening in life, so in France, ever since the first revolution, the corresponding class has inclined to the active and chiefly military career which is offered by the great competitive school of the country. The importance of this competition is alluded to by more than one of the gentlemen who have kindly given us their opinion with regard to the influence of the Polytechnic Military Education. We select the words of Colonel Favé, Professor of Military Art in the Polytechnic and Aide-de-camp to His Imperial Majesty the Emperor:—

Competition for the appointments given upon leaving.

"*Ce qui caractérise l'Ecole Polytechnique, et lui donne ses avantages, c'est*
"*que fournissant d'abord aux jeunes gens le moyen d'acquérir par leur travail*
"*une carrière honorable, puis leur offrant ensuite le choix entre plusieurs car-*
"*rières, elle les excite, pour l'admission et la sortie à des efforts extraordinaires.*
"*De là vient qu'il n'existe peut être pas au monde d'auditoire aussi animé a l'étude*
"*et aussi intelligent que celui de l'Ecole.*" Evidence, p. 46.

It cannot, however, be denied that many military men hold a different opinion on this point. The opposite views are curiously brought out in the valuable evidence of two Officers sent us by Lieutenant-Colonel Claremont, C.B. We print the answers side by side following the question to which they are a reply.

Question. *Pensez-vous qu'il résulte des avantages particuliers de la réunion dans le même régime, d'un enseignement commun d'élèves destinés aux fonctions civiles et à la carrière militaire?*

Answer 1.	Answer 2.
Il en résulte des inconvénients infinis.	*Un avantage qui est sans prix, celui de l'émulation, chacun étant obligé de faire des efforts pour arriver à la carrière qu'il ambitionne.*

3. A preparatory school of this remarkable character cannot but exercise a very powerful influence over those three-fourths of its pupils who leave it to

enter the army. The obvious question is whether the attempt is not made to teach more than is either necessary or desirable for military purposes, and to this suspicion may be added the fact that the civil prizes being more in request than the military, many of those who enter the army do so in the first instance reluctantly, and that the pupils at the bottom of the list appear to be often such marked failures as to imply either great superficiality or premature exhaustion.

See the words of Col. Favé, p. 46, of M. Duhamel, p. 48.

On this subject, see the Evidence.

4. In studying the Polytechnic School we have had these points constantly brought before us, and feeling the difficulty of discussing them fully, we beg to invite attention to the evidence sent us in reply to some questions which we addressed on the subject to some distinguished scientific Officers and civilians connected with the school. We will give briefly the result of our own inquiries.

Complaints of General Paixhans and of others.

5. The complaint of General Paixhans has been quoted some pages back. He urges that a considerable proportion of the army pupils are mere *queues de promotion*, and quite insufficient to form *le corps et surtout là tête* of troops *d'élite*.

Other not inconsistent complaints we heard ourselves of the mental exhaustion and the excessively abstract tendencies of many of the military pupils of the school; and some of these are forcibly stated in the evidence sent to us by Colonel Claremont in reply to the inquiry, "whether there is thought to be any "excess of scientific pursuits in the French Artillery and Engineers, and "whether, if such is the fact, the studies of the Polytechnic are the cause "of it?"

"*Oui, oui; la somme de connaissances abstraites que nous exigeons pour "l'admission à cette Ecole, et pour l'entrée dans le service des Mines, Ponts et "Chaussées, &c. est beaucoup trop étendue pour ceux de nos jeunes gens qui "aboutissent de gré ou de force à l'Artillerie et au Génie. Leur cerveau "fatigué d'études mathématiques compliquées, leurs vues incessamment dirigées "vers l'abstraction, ne redescendent pas facilement à terre, à la terre des "études et des travaux pratiques, lesquels sont en définitive ceux qui sont "nécessaires au jour de la lutte en campagne, dans une armée assiégeante ou "dans une place assiégée.*"

To what extent justified.

Cases of failure not very numerous.

6. Such are the complaints. There is certainly reason to think that, with regard to the twenty or thirty lowest pupils on the list, those of General Paixhans are well founded. These are the *breaks down*, and we are at first surprised that, entering as they must do,* with high attainments, they should

* The students are selected, by a competitive examination, out of a very large number of candidates, as will be seen from the following Table, extracted from the yearly calendars :—

Year.	Candidates who inscribed their Names.	Candidates examined.	Candidates admitted to the Polytechnic.	Year.	Candidates who inscribed their Names.	Candidates examined.	Candidates admitted to the Polytechnic.
1832	567	468	183	1839	530	531	135
1833	367	304	110	..	..	..	..
1834	627	541	150	1842	709	559	137
1835	729	633	154	1843	802	559	166
..	..	..	..	1844	746	531	143
1837	629	508	137	1845	780	559	136
1838	533	410	131				

Giving an average of one student for four candidates *examined*, so that it is impossible to imagine that there is any lack of ability in those selected.

A similar result appears to follow from some other more recent statistics.

Year.	Number of Candidates who inscribed their Names.	Number declared admissible to the Second Examination.	Number admitted.
1852	510	216	202
1853	494	222	217
1854	519	238	170
1855	544	232	170

In judging, however, of these numbers, it should be borne in mind that a very large number of the candidates who succeed have tried more than once; the successful of this year have been

fall so low as the marks in the Tables (with which we were most liberally supplied) prove to be the case.*

At the same time, we believe that no teaching ever has provided or will provide against many failures out of 170 pupils, even among those who promised well at first: and if the standard of the majority of pupils is high at the Polytechnique, and the point reached by the first few *very* high, it is no reproach that the descent amongst the last few should be very rapid.

Generally the amount of scientific study not too great.

With regard to the assertion, that the teaching is excessive and leads too much to abstract pursuits for soldiers,—it may be partially true. Perhaps the general passion for science has led to an overstrained teaching for the army, even for its scientific corps; and yet would it be allowed by Officers of the highest scientific ability, either in the French or the English army, that less science is required for the greatest emergencies of military than for those of civil engineering, or for the theory of projectiles than for working the department of saltpetre?

It may, however, be true that an attempt is made at the Polytechnic to exact *from all* attainments which can only be reached by *a few*.

The influence of the School on the Army generally good.

7. With this deduction, we must express our opinion strongly in favour of the influence of the Polytechnic on the French army. We admit that in some instances pupils who have failed in their attempt at civil prizes enter the army unwillingly, but they are generally soon penetrated with its *esprit de corps*, and they carry into it talent which it would not otherwise have obtained. Cases of overwork no doubt occur, as in the early training for every profession, but (following the evidence we have received) we have no reason to think them so numerous as to balance the advantage of vigorous thoughtful study directed early towards a profession which, however practical, is eminently benefited by it. "It cannot be said," was the verdict of one well fitted to express an opinion, "that there is too much science in the French army."

The character of the School thoroughly peculiar and national.

8. Assuming, however, the value of the scientific results produced in the French army by the Polytechnic, it by no means follows that a similar institution would be desirable in another country. Without much discussion it may be safely said that the whole history and nature of the institution—the offspring of a national passion for system and of revolutionary excitement—make it thoroughly peculiar to France.

Some obvious defects. Exclusion of books and deficiency of written examinations.

9. Some obvious defects must be noticed. The curious rule of forbidding the use of *all* books whatever is a very exaggerated attempt to make the pupil rely entirely on the Professors and *Répétiteurs*. The exclusive practice of *oral* examination also seems to us a defect. Certainly every examination should give a pupil an opportunity of showing such valuable qualities as readiness and power of expression; but an examination solely oral appears to us an uncertain test of depth or accuracy of knowledge; and however impartial or practised an examiner may be, it is impossible that questions put orally can present exactly the same amount of difficulty, and so be equally fair, to the several competitors.

At the same time, although in all great competing examinations the chief part of the work (in our opinion) should be *written*, the constant oral cross questioning of the minor examinations at the Polytechnic, appeared to be one of the most stimulating and effective parts of their system.

Excessive scientific tendency, to the exclusion of other studies.

10. A more serious objection than any we have named lies against the exclusive use of mathematical and scientific training, to the neglect of all other, as almost the only instrument of education. The spirit of the school, as shown especially by its entrance examinations, is opposed to any literary study. This is a peculiar evil in forming characters for a liberal profession like the army. Such a plan may indeed produce striking results, if the sole object is to create distinguished mathematicians, though even then the acuteness in one direction is often accompanied by an unbalanced and extravagant judgment in another. But a great school should form the whole and not merely a part of the man; and as

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among the unsuccessful of last year, so that the proportion of individuals who succeed to individuals who fail, is, of course, considerably larger than one to four. Of the 170 candidates admitted in November 1855, 117 had put down their names for the examination of 1854, and 53 only had not been previously inscribed. Of the 117 who put down their names, 19 had withdrawn without being examined at all, 71 had been rejected on the preliminary examination, 27 had been unsuccessful at that of the second degree; 98 of the 170 came up for the second time to the examination.

* *See* Appendix E.

doing this, as strengthening the whole mind, instead of forcing on one or two of its faculties—as giving, in a word, what is justly called a *liberal* education—we are persuaded that the system of cultivating the taste for historical and other similar studies, as well as for mere science, is based on a sounder principle than that which has produced the brilliant results of the Polytechnic.

Prejudicial influence, in this latter respect, on the previous education.

11. It may be added, in connexion with the above remark, that as the entrance examination at the Polytechnic influences extensively the teaching of the great French schools, and is itself almost solely mathematical, it tends to diffuse a narrow and exclusive pursuit of science, which is very alien from the spirit of English teaching.

General results.

12. We may sum up our remarks on the Polytechnic School thus:—

Regarded simply as a great Mathematical and Scientific School, its results in producing eminent men of science have been extraordinary. It has been the great (and a truly great) Mathematical University of France.

Regarded again as a Preparatory School for the public works, it has given a very high scientific education to civil engineers, whose scientific education in other countries (and amongst ourselves) is believed to be much slighter and more accidental.

Regarded as a School for the scientific corps of the Army, its peculiar mode of uniting in one course of competition candidates for civil and military services, has probably raised scientific thought to a higher point in the French than in any other Army.

Regarded as a system of teaching, the method it pursues in developing the talents of its pupils appears to us the best we have ever studied.

It is in its studies and some of its main principles that the example of the Polytechnic School may be of most value. In forming or improving any Military School, we cannot shut our eyes to the successful working at the Polytechnic of the principle, which it was the first of all schools to initiate, the making great public prizes the reward and stimulus of the pupil's exertions. We may observe how the State has here encouraged talent by bestowing so largely assistance upon all successful, but poor pupils, during their school career. We may derive some lessons from its method of teaching, though the attempt to imitate it might be unwise. Meanwhile, without emulating the long established scientific prestige of the Polytechnic, we have probably amongst ourselves abundant materials for a military scientific education, at least as sound as that given at this great School.

THE SCHOOL OF APPLICATION FOR THE ARTILLERY AND ENGINEERS AT METZ.

General Description.

Artillery Schools before the Revolution of 1789.

The first French Artillery School was founded in the time of Louis XIV. (in 1679) at Douai. It had but a short existence: and it was only in 1720 (under the Regency), when the Royal Regiment of Artillery received a new organization, that schools of theory were permanently founded in each of the seven towns where there were garrisons of Artillery. But no academy properly so called was established before that founded by D'Argenson at La Fère, in 1756, with a staff of two Professors of Mathematics, and two of Drawing. This was transferred to Bapaume, near the Flemish frontier, in 1766, re-transferred to La Fère, and suppressed, among other schools, at the beginning of the Revolution.

La Fère.

Engineers Schools during the same period.

Of early Engineer Schools there was only one, the very distinguished School of Mezières, near the northern frontier. This was founded in 1749, also under the ministry of D'Argenson; Monge was a Professor there; and it had a very high reputation down to its suppression in the Revolution.

Mezières.

Provisional Schools at Châlons and Metz during the wars of the Revolution.

When the wars of the Revolution broke out, Provisional Schools for giving a brief course of rapid instruction were established at Metz for the Engineers, and at Châlons-sur-Marne for the Artillery. These had to supply, at a great disadvantage, the Officers needed for the protection of the invaded frontier.

Conversion of these into Schools of Application. Their combination into one School at Metz.

It was intended originally that the Polytechnic, established in 1794, should send Engineers direct to the army; but it was quickly found to be a better plan to allow the pupils destined for this service first to spend some little time at Metz; which thus, in October 1795, became a School of Application for Engineers. The Artillery Pupils in like manner went to Châlons. This separate system of two Schools of Application continued till 1802, when the establishment at Châlons was united with that of Metz, and Metz became what it has since continued to be, the seat of the United School of Application for the two services. The Polytechnic students who select the *Artillerie de terre*, *Artillerie de mer*, or the *Génie militaire*, enter here to receive the special and professional instruction deemed requisite to fit them for actual employment. The present organization of the School is laid down in the Imperial decree of the 24th June 1854, a translation of which is given in the Appendix.*

Entrance from the Polytechnic.

The students quitting the Polytechnic in the manner described in the account of that school, at the average age of 21, enter the School of Application, with the provisional rank, the uniform, and the pay of sub-lieutenants (*sous-lieutenants*). The ordinary term of residence is two years. Under special circumstances this may be shortened; and in case of illness or want of application individual students are occasionally retained for a third year. Each new body of students, each *admission* or *promotion*, is classified at the end of the first year, and the students composing it are arranged in order of merit in accordance with the reports of the professors, but without an examination; at the close of the second year they pass a final examination before the Board of Officers, and are definitively placed in the corps they have chosen, the Artillery or Engineers, according to the order of merit. They are allowed to count, as regards retirement from the service and towards military decorations, four years' service on account of the two years passed at the Polytechnic School, and of the time passed in preparing for admission to it, reckoning from the day of their admission to the School of Application.

Numbers.

There were in the school at the time of our visit (the first week of March 1856), 69 sub-lieutenants belonging to the Upper Division, which had completed one full year's residence, and 70 belonging to the Lower Division, which had been formed by the promotion from the Polytechnic in the previous October (1855), and had thus only recently commenced the first year. The Final Examination for the promotion to actual service of the students of the Upper Division was in progress at the time; the exigencies of war being such as to make it desirable to dispense with the nine months of additional instruction which the regulations require, and to allow them to quit the school after a stay of only

* Appendix H.

fifteen months. An additional extraordinary admission from the Polytechnic was expected in the month of May.

The Buildings.

Metz is a fortified place on the Prussian frontier, the seat of war at the time of the school's first foundation; it is on the line of railway to Mannheim, about thirty miles from the point where this branch diverges from the main line to Strasburg. The Moselle flows through the town, and is employed, with its little affluent the Seille, in the military defences. The garrison numbers 10,000 men; there is an Arsenal, a School of Pyrotechny for the manufacture of rockets, two Regimental Schools, one of Artillery and the other of Engineers. The School of Application occupies buildings erected on the site, and partly the original buildings themselves, of a suppressed Benedictine monastery. Three sides of the cloistered monastic quadrangle are devoted to the offices, lecture rooms, galleries, and halls of study. A fourth, formerly the ancient church, is converted into a *salle des manœuvres*. There is an adjoining residence for the Commandant; and a separate modern building, four stories in height, affords lodging to the young men.

Salle des Manœuvres.

The *salle des manœuvres* is a large area under a lofty roof, rising to the whole height of the buildings of the quadrangle; it contains artillery of various descriptions, mortars, field and siege guns placed as in a battery, and is amply large enough to allow cannon to be moved and exercises performed when the state of the weather may make it desirable.

Amphitheatres.

The amphitheatres or lecture-rooms, much on the same system as those at the Polytechnic, are two in number, one for each of the two divisions. Officers of the Artillery and Engineers who are in garrison, are entitled, if they please, to attend the lectures, and other officers also may be admitted by permission.

Museums.

The galleries, partly on the ground floor, partly on the first floor, contain very good collections of models of artillery, ancient and modern, of sets of small arms, of tools, of the locks, barrels, and other portions of muskets in various stages of the process of their manufacture, of specimens of carpentry and roofing, of minerals, of models of fortifications, bridges, coffer dams, locks, &c.

Library.

The library on the first floor has an adjoining reading-room; and near it is the examination room, of which further mention will be made.

Salles d'Etude.

The three halls of study (*salles d'étude*) on the first floor are on a different plan from those of the Polytechnic, each one being large enough to accommodate a whole division (70 students). Three rooms are also provided for the Professors to prepare their lectures in. The young men of the Junior Division, at the time when we visited the school, were seated at the desks in their halls, engaged in drawing up projects of fortifications under the superintendence of an Officer.

Barracks

The barracks, on the opposite side of the open space used for drill and exercises, form a lofty and handsome building, entered by separate staircases, the ground-floor rooms of each being assigned to a servant, who undertakes to provide attendance for all the young men lodging in the rooms above. The rooms are comfortable, mostly double-bedded, the bedroom serving also as a sitting-room, and a small adjoining closet being used for washing, &c. Twenty or twenty-two appear to be thus accommodated on each staircase; there are lodgings altogether for 145. A certain number of the senior sub-lieutenants would, probably, on the arrival of the new cadets from the Polytechnic, be removed to lodge in the town.

Riding School.

There is a riding-school adjoining the court; stables, for thirty-three horses, which are kept for the use of the pupils, and lodgings for the attendants are provided in the neighbourhood.

Daily routine.

The mere description of the buildings shows at once that the system is different in many respects from that of the Polytechnic. Young men of twenty-one and twenty-two years of age, already holding provisional commissions in the service, receiving the pay and wearing the uniform of sub-lieutenants, are naturally allowed much greater freedom of action. They live, and partly also study, not in the halls of study, but in their own rooms; they take their meals in the town, where they frequent the *cafés* and *restaurants* of their choice. The *rappel* summons them every morning to rise and attend a roll-call at half-past five or six; military exercises, riding, or interrogations, similar to the *interrogations particulières*, require the presence of a portion of the number, but the rest are free to return to their rooms. At ten they have to attend either the day's lecture, followed by employment in the halls of study, till four o'clock P.M., or they proceed at once to the halls of study, and set to work on

the drawings, designs, projects, &c., which are described hereafter in the account of the studies. From four to half-past five P.M. drill, exercises, and riding occupy a portion of the number, probably those who were not called for in the morning. After half-past five they are left to themselves.

Excursions for surveying, &c.

This ordinary routine of studies is interrupted in the summer months by the occurrence of expeditions for making surveys, and for measuring and sketching machines in manufactories. The young men are sent, two together, to survey (*lever à boussole*); singly for the reconnaissance sketch (*lever à vue*); and generally, a certain number are distributed about a district not too large for an officer to make his round in it, and see each day that all are at work. The railways afford considerable facilities; the expeditions never occupy more than ten days at a time, but they may be extended as far as Strasburg.

Interrogations particulières.

There are no *répétiteurs* in the school; but the system of *interrogations particulières* is carried on; and an examination by the professor and an assistant professor takes place after, about, every eight or ten lectures.

The Staff and Government.

The Establishment.

The Staff of the institution consists of—

1 General Officer, at present a General of Brigade of Artillery, as Commandant.
1 Colonel or Lieutenant-Colonel, Second in Command and Director of Studies, at present a Lieutenant-Colonel of Engineers.
1 Major of Artillery.
1 Major of Engineers.
5 Captains of Artillery.
3 Captains of Engineers.
1 Surgeon (*Médecin-Major*).

The Commandant is taken alternately from the Artillery and Engineers, and the command lasts for five years only.

The Second in Command is always chosen from that arm of the service which does not supply the Commandant.

The inferior officers of each rank are taken in equal numbers from the two arms.

The staff of Instructors is as follows:—

1 Professor of Artillery, at present a Captain of Artillery.
1 Assistant ditto also a Captain of Artillery.
1 Professor of Military Art, charged also with the Course of Military Legislation and Administration (a Captain of Engineers).
1 Professor of Permanent Fortification and of the Attack and Defence of places (a Captain of Engineers).
1 Assistant ditto ditto (a Captain of Engineers).
1 Professor of the Course of Topography and Geodesy (a Captain of Engineers).
1 Professor of Sciences applied to the Military Arts.
1 Professor of Mechanics applied to Machines (a Captain of Artillery).
1 Professor of the Course of Construction (a Captain of Engineers).
1 Assistant ditto.
1 Professor of the German language (a civilian).
1 Professor of Veterinary Art and Riding (a Captain of Artillery).
1 Assistant ditto (a civilian).
1 Drawing Master, Chief of the Drawing Department (a civilian).

In all, nine Professors, four Assistant Professors, and one Drawing Master.

The School employs in addition an administrative staff, consisting of—

A Treasurer, } both of whom must have been Officers in the Artillery or
A Librarian, } Engineers.
A Principal Clerk.
An Assistant Librarian.
Two Storekeepers, entrusted with the *matériel* belonging to the two arms.
One skilled Mechanic.
One skilled Lithographer.
One Fencing Master.

Clerks and Draughtsmen are provided as required.

Governing Boards.

The School is under the general superintendence of two Boards or Councils, the Superior Council and the Administrative Council.

The Superior Council.

The Superior Council consists of the General Commandant, as President, the Second in Command, the Director of Studies, as Vice-President; the Major of Artillery, and the Major of Engineers, as permanent members; two Captains of the Establishment, one of each arm; two Military Professors, one of each

arm; and one Captain of the Establishment; these five last being all removable at the General Inspections.

The Superior Council has the duty of drawing up the program of the studies of the year, of suggesting changes in the regulations relating both to studies and discipline, all subject to the approval of the Minister of War; of preparing at the end of the year the classified list of the students, drawn up according to their conduct and progress in their studies, and of pointing out to the Jury of Examiners any students who should go again through the courses of the year, and stay in consequence an additional year at the school.

The Council of Instruction.

When questions relating to the instruction are brought before the Superior Council, the whole body of military professors attend and take part in the proceedings, and the Council is thus said to be constituted as a Board or Council of Instruction. Improvements are here suggested, and are subsequently submitted to the Jury of Examiners, and to the Minister of War; the value to be attached, in the system of marks or credits, to each particular course of study is determined; a statement is drawn up showing what printed works, models, &c., are wanted. The budget itself, to be submitted to the Minister of War, is finally drawn up by the Superior Council in its ordinary sittings.

The Administrative Council.

The Administrative Council, composed of the Second in Command as President, the two Majors of Artillery and of Engineers, one Captain and one Military Professor, and the Treasurer as Secretary without the right of voting, takes cognizance of all the financial and other business matters of the school. The details are given in the Decree.*

Subjects and Method of Study.

Subjects and character of the instruction.

The studies at Metz consist of topography and geodesy, including military drawing and surveying under special circumstances; field fortification, military art and legislation, permanent fortification, and the attack and defence of fortified places, accompanied by a sham siege, without, however, executing the details practically on the ground; architecture, as applicable to military buildings and fortifications; the theory and practice of construction, and artillery. The programs of these studies are inserted at length in the Appendix.†

The instruction is given principally (as at the Polytechnic) by means of a series of lectures, and the knowledge which the students have acquired is first directly tested by requiring them to execute various kinds of surveys of ground, either with or without the use of instruments; to prepare drawings of buildings, workshops, and machines in full detail (plan, elevation, and sections) from the measurements they have recorded in their note-books or on their sketches, and to accompany such drawings with descriptive memoirs of all particulars and calculations that may be necessary to exhibit their purpose or efficiency; to draw up projects and lay out works of field and permanent fortification, or of those of attack or defence of a particular place on certain given data, or according to the nature of the ground; to design a military building, bridge, machine, or piece of ordnance, accompanied by estimates and descriptive memoirs, showing in what manner the instructions and conditions under which it was drawn up have been complied with; and to prepare a project for the amelioration of the works of defence of a specified portion of a fortified place known to be defective in some respects.

First year's studies.

The instruction during the first year's residence is common to the two arms; and the time is appropriated in the following manner, viz.:—

	Days.
Military art and legislation	33
Topography and geodesy	47
Field fortification	39
Permanent fortification	88
Theory and practice of construction	77
Total	284

* See Appendix H. † See Appendix I.

The *sous lieutenants* who complete their first year's work are allowed nearly a month's vacation during November.

The instruction given to the Artillery and Engineers during the second year's residence is not entirely the same, as will be seen by comparing the accompanying Table of the year's study:— Second year's studies.

	Artillery.	Engineers.
	Days.	Days.
Military art and legislation	2	2
Topography and geodesy	28	28
Attack and defence of places	44	44
Permanent fortification	44	129
Artillery, machines, &c.	81	—
Theory and practice of construction	46	42
	245	245
Brought forward from first year	284	284
Total	529	529

We should not omit to state that there is a short course on the Veterinary Art.

The lectures, as before said, begin at 10 A.M., and they last usually an hour and a half, and are followed by work in the halls of study. It would appear, however, that very frequently the day's occupation consists simply of work in the halls of study (or occasionally out of the school buildings, when the students are sent on some excursion); and, accordingly, in giving the account of the studies, a *day* or day's work will sometimes mean a lecture followed by drawing or other employment, sometimes this drawing or other employment without any lecture preceding. Taking a general average, the proportion appears to be about two lectures to five *séances*, *i.e.*, sittings without lectures. The day's work.

The system will be better understood by referring to the accompanying Tables, which are translated from the Project for the Employment of Time for the year 1851-2, submitted for the approval of the Minister of War. The dates in the first column indicate the days of the commencement of each particular study. The school year, it should be said, begins on the 1st of December.

EMPLOYMENT of TIME for the Years 1851–1852.

Month and Date.	Second Division. First Year's Instruction.	Number of Attendances.	Lectures before Work.	Total of Lectures.
December 1	Lectures on Military Art in Topography—Conventional Tints	2	—	—
„ 2				
„ 4	Study of Hill Drawing (in sepia with contour lines)	2	—	—
„ 6	Military Art — Plate 1 - 5; Plate 2 - 5; Plate 3 - 5; Plate 4 - 5; Plate 5 - 9	29	4	39
January 12	Front of Cormontaigne	24	3	13
February 9	Project of Field Fortification — Plate 1. Plan of the whole - 3; Plate 2. Organization of a work 8; Plate 3. Details of Construction 4; Memoir 4	19	5	7
March 3	Plan of Stability of Revetments, &c.	9	9	9
„ 13	Study of the Drawing showing the effect	8	1	1
„ 23	Plan of a Building — Out-of-door Work 9; Laying down and drawing, Memoir 23	32	—	—
April 29	Topographical Triangulation	4	4	6
May 5	Defilement and Profiling on the Ground	3	—	—
	Project of a Building — Sketches - 14; Drawing - 24; Memoir - 4; Estimate - 3	45	12	22
June 28	Survey with a plane-table — Out-of-door Work - 10; Laying down and drawing 3	13	1	—
	One day free in case of bad weather	1	—	—
July 14	To find the Variation of the Needle	1	1	—
„ 17	Survey of Ground with the Compass — Out-of-door Work - 8; Laying down and drawing 2	10	1	—
	One day free in case of bad weather	1	—	—
August 2	Reconnaissance Plan—Out-of-door Work	6	1	—
	One day free in case of bad weather	1	—	—
„ 10	Study of Shaded Drawing (*Hachures* and coloured)	8	1	—
„ 18	Laying down and drawing the Survey made with the Compass	2	—	—
„ 20	Project of Fortification on Level Ground — Plate 1 - 6; Plate 2 - 30; Memoir - 6	42	3	19
September				
October 8	Project of Fortification on Hilly Ground — Plate 1 - 19; Memoir - 3	22	8	10
November 3	Last day of week.			
„ 6	Leave for their Vacation.			
	There remains therefore in this division:—1st. Three free days in case of bad weather; one after each survey. 2d. Two days at the end of the year, the 4th and 5th Nov. Total five free days.			
	Total of the days employed 279 + 5 days free	284		

EMPLOYMENT of TIME for the Years 1851-1852.

Month and Date.	First Division. Second Year's Instruction.	Number of Attendances.	Number of Lectures before Work.	Number of Total of Lectures.
	Brought forward - - - -	284	—	—
December 6	Laying down the First Survey by Reconnaissance - - -	8	—	—
„ 16	Attack and Defence:—Plate, Batteries, with Plan and Sections of Detail - - - - - - - - -	4	5	6
„ 20	Ditto - - - { Plate 1 - - 25 / Journal - - 2 / Plate 2 - - 13 } - - - -	40	6	20
January				
February 7	Designs and Constructions of Revetments, Arches, &c. - -	9	9	9
„ 18	Project of permanent Fortification in Hilly Ground - - { Plate 1 - - 19 / Memoir - - 3 / Plate 2 - - 8 } - -	30	8	19
	SPECIAL WORKS.			
	ARTILLERY. / ENGINEERS.			
March 25	Measurement and Drawings of a Cannon - - - 12 / Project of Fortification in Hilly Ground, Plate 2 *cont.* 12	12	—	—
April 8	Measurement of a Workshop - - / Out-of-door Work - -	9	30	30
„ 19	Laying down the Measurement 28 / Laying down the Measurement 24			
May 18	/ Project of Fortification in Hilly Ground, Plate 3 - 14			
„ 24	Project for Machines - - 14			
June 4	/ Abstracting and calculating Measurements - - - 3			
„ 8	/ Plate 4 - - - - 11			
„ 9	Questions in Artillery - - 5	97	2	2
	1st. Measurement of *Matériel*, Gun Carriages, &c. - - 8 / Register of the Removal of Earth - - - - 3			
	Laying down ditto - - 10 / Estimate - - - - 2			
	/ Memoir - - - - 2			
	/ Project for Improvements { Plate 1 - - 30 / Plate 2 - - 6 / Memoir - 2 }			
July 6	2d. Measurement of *Matériel* 8			
„ 15	Project for a Cannon - - 24			
	97			
August 12	Second Reconnaissance Survey - - - - -	—	—	—
	Out-of-door Work and Tracing of the Lines on the Reconnaissance Plan	7	—	—
	One day free in case of bad weather - - - - -	1	—	—
„ 21	Geodetical Calculations - - - - - -	4	—	—
„ 26	Laying down the Reconnaissance Survey - - - -	8	—	—
September 4	Memoir on Entrenched Lines - - - - -	1	—	—
„ 6	Tracing or laying out Camps - - - - -	1	—	—
„ 7	Operations of a Sham Siege - - - - - -	13	—	—
	One day free - - - - - - -	1	—	—
„ 19	Preparing for the Examination - - - - -	—	—	—
October				
November 1	Examination for leaving - - - - - -	—	—	—
	Total of the days employed, 522 + 7 days free.	529		

Final Examination.

Final Examination.

About six weeks of free or voluntary study is allowed, immediately prior to the Final Examination, for the sub-lieutenants to prepare for their last effort.

Board of Examiners.

The examination which takes place prior to their leaving the School of Application, is entirely conducted by a Board of six officers, under the presidency of a General Officer alternately of the Artillery or Engineers, the remaining members of the Board consisting of a General Officer of each corps and three Field officers of these corps; the last three being specially charged with the duty of examining. It takes place in a room set apart for the purpose, with a small interior room in connexion with it, into which the members of the Board retire to deliberate at the end of each student's examination. The Jury assembles each year at the period fixed by the Minister of War.

Process; a *vivâ voce* examination in three different branches, by one Examiner for each, and by the President or other Members of the Board.

The three Examining Members conduct the examination of the students in three different branches of study; the first more particularly relating to Artillery Science, the second to Engineering Science, and the third to Mechanical Science in its connexion with the Art of War. The whole of the students who are to leave the School are first examined in such one or other of these branches of study as may be determined on.

The Student under examination is specially questioned by the Examining Officer in his subject, and occasionally by the President or any other Member of the Board that may wish to do so, for three-quarters of an hour. As soon as the examination of the Student has been concluded, the Board retire to the adjoining room and compare their notes of the credits they have severally awarded to the Student under examination, and they also examine his drawings, sketches, and memoirs relating to the subjects on which he has been questioned, and prepared during his two years of residence in the School. They severally note the credits to which they consider him to be entitled for them, and adopt the general mean.

As soon as the examination of the whole of the students in this particular study has been finished, the examination in the next branch is commenced, so that five or six days elapse between the first and second examinations of the same student; and the same interval of time occurs between the second and third examinations.

Classification, credits, and co-efficients.

The credit allotted to each Student by the Board of Examiners represents, on the scale of 0 to 20, the manner in which he has replied to the questions, or executed the drawings, sketches, memoirs, &c., belonging to each course. The importance attached to each particular branch of study is estimated very nearly by the amount of time allowed for its execution divided by 20; and the definitive marks which each student obtains for that branch of study is obtained from the products of the numbers respectively representing the credit for answering, and that for the importance of the subjects on which he has been examined.

The final classification in the order of merit, in each arm of the service, is arranged after a comparison of the total of the marks obtained by each student. This total is the sum of the definitive marks gained by each student in the sciences bearing on Artillery, Engineering, and Mechanics in connexion with the Art of War, for the talent displayed in drawing, sketching, and writing memoirs, and for skill in practical exercises, as determined by the results of the examination conducted by the Jury of Examiners, added to the marks due to the previous classification in the school, with the weight or influence equal to one-third of that allowed for the examination by the Jury.

The co-efficients of influence for the present year, for the above studies are—

For those particularly relating to Artillery Science	39·29
„ „ „ Engineering Science	53·75
„ „ „ Mechanical Science	43·00
For talent in drawing, sketching, writing memoirs, &c.	6·80
For practical exercises	16·75
Previous classification in the School	45·30

So that the examination conducted by the Jury of Examiners exercises an influence on the position of the Students very nearly approaching to two-thirds of the whole amount.

Final classification fixes seniority.

It is this final classification which determines their seniority in the respective services.

By the kindness of the Commandant of the School, and that of the President of the Jury, we were permitted to be present during the examination, which was entirely oral, of two of the *sous-lieutenants*, before the Jury of Examiners. Examination attended by the Commission.

The questions were replied to with great fluency and readiness, but it seemed to us that the examination was somewhat limited for the object in view, viz., that of awarding a credit representing the progress which each Student had made in the particular science on which he had been questioned, especially as that credit would have very great weight in determining the candidate's future position in the Service.*

Subsequent Instruction and Employment.

On quitting the School of Application at Metz, the Sub-Lieutenants of Artillery and Engineers respectively join the regiments, to which they are then definitely assigned as Second Lieutenants, and continue to be employed in doing duty, and in receiving practical instruction with them, until they are promoted to the rank of Second Captain. After joining, the Officers remain with the troops till they become Second Captains.

The Lieutenants of the Artillery are employed on all duties that will tend to make them efficient Artillery Officers, and fully acquainted with all details connected with the drill, practice, and manœuvres of the Artillery, and also with the interior economy and discipline of a Regiment of Artillery. In the Artillery, on becoming Second Captains, they are detached to Arsenals, &c.

After the Officers of Artillery are promoted to the rank of Second Captain, but not before, they are detached from their regiments and successively sent into the various arsenals, cannon foundries, powder mills, and small arm manufactories, pyrotechnic establishments, and workshops, in order that they may become practically acquainted with the whole of the processes connected with the manufacture and supply of artillery, rockets, small arms, powder, material of all kinds, tools, &c., and also with the construction and repair of the buildings and factories required for these purposes. Sometimes they are employed as assistants in these establishments. The Inspectors of the arms of regiments are selected from among those who have become acquainted with the manufacture of small arms.

When promoted to First Captains they again rejoin their regiments, so that they may not lose the qualifications and knowledge required from a good practical artillery officer.

Field-officers of Artillery are employed as Superintendents and Directors, and Captains as Sub-Directors, of the important works entrusted to their arm.

In time of war, the Officers of Artillery have the construction of their own batteries, and the direction of the ordnance in battles and sieges, together with the formation of moveable bridges and passages by boats.

It must be noticed, in contradistinction to the practice which prevails in England, that the Artillery and Engineer services manufacture their own tools.

The young Engineer Officers are employed with the men of their regiments, and with them pass through courses of practical instruction in the field, in sapping, mining, field fortification, sham-sieges, bridges, and castrametation. During this practical instruction one of the Lieutenants belonging to each company is always present, and the Captain of the company visits the work once in the course of the day. In the Engineers.

* The examination chamber is a small room in the school buildings, near the library, ornamented with portraits of Vauban, and of D'Argenson, under whose Ministry the original schools at La Fère and Mézières were founded. At a large table under these portraits, and extending across the room, General Morin, President, and four Officers, Members of the Jury, were seated. The sixth Member sat at a small table in front, near the black board at which the student stood. The Commandant, the Director of Studies, and the other Officers of the school were seated also in this part of the room.

The student who was first examined was questioned partly by the examiner, partly by the president, and gave his answers, working problems and drawing illustrations on the board as he went on. He was asked questions as to details of the steam engine, and as to the method of casting cannon. The German teacher of the school put him on to construe from a German book, and tried him in speaking; he succeeded just passably in both. The whole occupied about three quarters of an hour.

The second student, after answering similar scientific questions, had opportunity given him to show his knowledge, which was considerable, of the geology of the neighbourhood; and having lived in foreign countries, he was able to make a very good display of his knowledge of German, Spanish, Italian, and English.

After each examination the jury retired into the inner cabinet, by a door opening to it from behind their seats.

The duties of the Officers of Engineers in time of peace are the construction preservation, and repairs of fortresses and military buildings, and the command and instruction of the Engineer Soldiers.

In time of war, the Officers of Engineers are entrusted with the construction of works of permanent fortification, of the general works in the attack and defence of fortresses, and the reconnaissances connected therewith.

They *may* also be charged—

With the construction of such works of field fortifications as the Commander-in-chief or the Generals of Division consider necessary; such as as *épaulements*, trenches, redoubts, forts, blockhouses, bridge heads, entrenched camps, as well as the opening of communications, the establishment of bridges resting on fixed supports, and the formation and destruction of roads.

After the Officers of Engineers have been promoted to the rank of Second Captain, and not before, they are mostly employed apart from their regiments, on the *état major* of the Engineers in fortified towns and places, either in charge of the existing military buildings and fortifications, or with the duty of carrying on, or assisting to carry on, such new works as are in course of construction from time to time.

Promotion.

We have already stated that by the law in France one-third of the officers of the Army is obtained from the Military Schools; one-third from the non-commissioned officers who have been raised to that grade from the ranks; while the remaining third is placed at the disposal of the supreme executive power. As regards the Artillery and Engineers this last third is in actual practice obtained, like the first third part, from the Polytechnic School, so that only one-third of the officers of those arms are promoted from among the non-commissioned officers, and these seldom rise above the rank of Captain. Much attention is, however, paid to the improvement of the education of these latter Officers, and we found that *four* officers of Engineers and *one* officer of Artillery so promoted were, by order of the Minister of War, on the recommendation of the Inspectors-General, passing through the School of Application at Metz, the course of instruction for them being modified on their account. And it was confidently expected that a large number of those officers who had been promoted in this way during the war would be ordered to the School of Application at Metz.

Officers promoted from the ranks; attention paid to their education.

Exchanges.

We should not omit to mention that occasional exchanges of service take place, during the first year of residence at Metz, among the pupils destined for the Artillery, and those destined for the Engineers.

Pay.

The pay of officers of the Artillery and of the Engineers is the same. A small additional allowance is granted to officers of Artillery when mounted.

ARTILLERY REGIMENTAL SCHOOLS.

Ten in number.

There are ten Regimental Artillery Schools established in places or towns that are usually garrisoned by the troops of this arm, and one of these schools exists at Metz, but we did not visit it, as we were informed that, from the exigencies of the war, it was not in its proper normal state. At the present time there are also two provisional schools.*

ENGINEER REGIMENTAL SCHOOLS.

Three in number.

The soldiers of the Engineers appear to be very well taught in their Regimental Schools, of which there are three, one for each regiment, established at Metz, Arras, and Montpellier, where the regiments are usually in garrison. The strength of each regiment is 4,500 men.

Instruction, theoretical and practical.

The instruction given in these schools has for its object to afford, to its full extent, to the officers,† *sous-officiers*, and soldiers of the Engineers, the requisite theoretical and practical knowledge to enable them satisfactorily to fulfil the duties of their various ranks, and to qualify them for promotion to higher rank.

It is so regulated that at the end of the first year the men have learnt the nature of the service and duties of a soldier; and that at the close of the second year, the practised sapper is cognizant of mining, and the practical miner is acquainted with sapping.

In the lowest classes the men begin with learning to read and write; this is followed by arithmetic, grammar, writing from dictation, and composition. The next subjects are special mathematics, landscape, plan, topographical and architectural drawing. We attended a class in which a corporal of sappers was explaining to the mathematical teacher (a civilian) the theory of the inclined plane, and we saw a large number of their drawings, topographical and architectural, many of which were very well executed.

The theoretical instruction is given between the months of November and March, the practical instruction in the field (already noticed) occupies the rest of the year. The combined courses are completed in two years.

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* We have given in the Appendix J. an account in some detail of the course of instruction, both at the Artillery and at the Engineer Regimental Schools.

† This applies particularly to the officers promoted from the ranks.

REMARKS RECEIVED FROM EMINENT PERSONS IN FRANCE ON THE EDUCATION OF OFFICERS FOR THE ARTILLERY AND ENGINEERS.

In answer to some questions on the subject of the education of Officers for the Artillery and Engineers, we were favoured with valuable remarks from General Viscount de la Hitte, President of the Consulting Committee of Artillery; from a distinguished General Officer connected with the Engineer service; from Lieut.-Colonel Favé, of the Artillery, Professor of Military Art at the Polytechnic, and Aide-de-Camp to His Majesty the Emperor; from M. Duhamel, Member of the Institute, Professor, and formerly Director of Studies, at the Polytechnic;—

i. Answers from General De la Hitte.

From General De la Hitte.

Questions.	Replies.
As to the amount of knowledge required for Officers of the Scientific Corps. 1. Si l'on fondait en Angleterre une école exclusivement destinée à fournir des officiers pour l'Artillerie et le Génie, quelle serait, d'après l'expérience faite par la France, la somme des connaissances exigibles?	Si la durée des cours de cette Ecole était fixée à deux années, comme celle des cours de l'Ecole d'Application de l'Artillerie et du Génie de Metz, l'expérience de la France permettrait de penser que la somme des connaissances exigibles pour l'admission dans l'Ecole projetée en Angleterre devrait être celle des élèves admis à l'Ecole Impériale d'Application de Metz. Si la durée des études était plus longue, l'étendue des connaissances exigibles avant l'entrée, serait naturellement moindre.
2. Quelle est selon vous la somme des connaissances mathématiques qu'on doit exiger des officiers appartenants à ces deux corps pour l'accomplissement habituel de leurs fonctions?	Le dernier mot sur cette question est donné par les derniers programmes d'études de l'Ecole Polytechnique et de l'Ecole Impériale de Metz.
As to any differences between the Artillery and Engineers. 3. En France, l'Ecole Polytechnique donne des Officiers à l'Artillerie et au Génie. Exige-t-on des connaissances mathématiques, ou autres, plus avancées pour un corps que pour l'autre?	Aucune différence n'existe entre les connaissances mathématiques ou autres exigées pour la sortie des Elèves de l'Ecole de Metz, qu'ils appartiennent à l'Artillerie ou au Génie, à l'exception toutefois des connaissances qui font l'objet d'un très petit nombre de leçons données exclusivement aux Officiers Elèves de l'une ou de l'autre arme, par suite de la spécialité toute particulière des matières enseignées dans ces quelques leçons, réservées d'ailleurs pour la fin des deux années d'études.
4. Offre-t-on aux élèves des avantages pécuniaires ou d'autres pour les engager à choisir un corps plutôt que l'autre?	Le choix des élèves (sortant de l'Ecole Polytechnique) est abandonné à leur libre décision. Mais leur admission dans chaque arme dépend du nombre des places à donner et du rang de sortie que l'élève a obtenue par suite de ses examens. Les règlements de solde et les lois et décrets sur l'avancement et la constitution des deux corps leur font une part d'avantages à peu près égale.
As to the union of the two Corps. 5. Croyez-vous qu'il soit désirable, ou non, à l'egard de leur instruction, et plus tard utile aux services publics, que l'Artillerie et le Génie soient réunis en un même corps?	L'expérience faite en France de 1756 à 1758, de la réunion complète des corps de l'Artillerie et du Génie, a eu pour conséquence de faire ressortir la convenance de leur séparation. Faire de ces deux corps deux spécialités distinctes, mais rapprochées par la communauté de l'origine et par des rapports fréquents de service, est un principe consacré par l'épreuve du temps et de la guerre.

6. Pensez-vous que dans l'Artillerie et le Génie Français il y ait trop de connaissances théoriques en comparaison des connaissances pratiques des officiers? Et s'il en est ainsi, en faites vous remonter la cause à l'influence de l'Ecole Polytechnique, ou bien y assignez-vous toute autre cause?

Effects on the two Corps of the system of taking pupils from the Polytechnic.

On ne voit pas en quoi les connaissances théoriques des élèves de l'Ecole Polytechnique les empêcheraient essentiellement d'acquérir les connaissances pratiques nécessaires à leur métier militaire. Les programmes d'instruction de l'Ecole Polytechnique ont été révisés en 1853 de manière à faire une certaine part aux connaissances pratiques, et les deux années que les officiers passent à l'Ecole de Metz sont bien suffisantes pour compléter leur instruction sous le rapport des connaissances pratiques.

Les faits justifient l'Ecole Polytechnique de l'influence regrettable qu'on lui attribue quelquefois sur la composition de ces deux corps. En est-il où les officiers soient animés d'un plus grand amour du devoir, d'un plus grand dévouement à la religion militaire, où les officiers soient plus respectés de leur troupe?

L'histoire de nos tourmentes politiques fait ressortir la solidité de la discipline de nos régiments de l'Artillerie et du Génie, comme tous les bulletins de nos armées consacrent la bravoure et le mérite de leurs officiers.

7. Croyez-vous que le service de l'Artillerie et du Génie fût affecté avantageusement, ou désavantageusement, si l'admission des jeunes gens à l'Ecole d'Application à Metz dépendait simplement d'un examen sévère et du concours, sans exiger qu'ils eussent suivi un cours d'instruction théorique dans une des écoles de sciences spéciales?

Probable effects of sending pupils direct to a School of Application, without a previous theoretical course.

Pour former de bons officiers il faut les soumettre le plus tôt possible à la discipline, à la vie militaire. On peut avancer avec confiance que la qualité moyenne du recrutement des élèves de l'Ecole de Metz baisserait sensiblement, s'ils n'avaient déjà été soumis à la discipline de l'Ecole Polytechnique.

9. En admettant la fondation d'une école spéciale d'Artillerie et du Génie, quelles sont parmi les parties d'enseignement suivies actuellement à l'Ecole Polytechnique et imposées aux élèves qui se destinent à des services civils, celles qui pourraient être ou conservées ou retranchées? En est-il d'autres, qu'on pourrait y ajouter?

As to the effects of admitting into the Polytechnic pupils destined for the Civil Service.

Cette question semble rentrer dans la première, en partie du moins.

Il faudrait enseigner à l'Ecole de l'Artillerie et du Génie tout ce qui s'enseigne aux Ecoles Polytechnique et d'Application, et qui n'aurait pas été exigé d'avance pour l'entrée à cette Ecole.

Les nouveaux programmes de l'Ecole Polytechnique et de l'Ecole de Metz ont mis les études en harmonie avec ce que reclamaient depuis long temps les influences militaires; elles ont reçu satisfaction complète, et il n'y a en ce moment rien à retrancher des études qui ont plus particulièrement pour but les carrières civiles, comme rien à ajouter pour la spécialité militaire. L'enseignement de l'Ecole Polytechnique est un fond commun pour tous les candidats aux carrières qu'elle alimente; les Ecoles spéciales complètent leur instruction au point de vue particulier de leurs destinations définitives.

10. Pensez-vous qu'il résulte des avantages particuliers de la réunion dans le régime d'un enseignement commun d'élèves destinés aux fonctions civiles et à la carrière militaire?

Il est permis d'en douter, mais l'Ecole Polytechnique a acquis en France un trop grand renom, pour que les armes de l'Artillerie et du Génie ne désirent pas continuer de prendre leurs officiers parmi les élèves de cette Ecole.

11. Dans l'hypothèse où nous recommanderions l'établissement d'une commission analogue au Conseil de Perfectionnement, quelles données l'expérience de l'Ecole Polytechnique fournirait-elle à l'appui de cette recommandation?

As to the Board of Improvement.

L'institution de l'Ecole Polytechnique appelée à fournir des sujets pour différentes carrières, militaires et civiles, rendait nécessaire la création d'un Conseil de Perfectionnement. Mais si l'on ne forme en Angleterre qu'une école pour le service de l'Artillerie et du Génie, les Inspecteurs Généraux des deux armes seraient naturellement les juges des perfectionnements successifs à introduire dans cette Ecole.

(Signed) General Vicomte de la Hitte.

Paris, le 25 Mars, 1856.

ii. Answers from a General Officer of Engineers.

From a distinguished General Officer of Engineers.

As to the amount of knowledge required for Officers of the Scientific Corps.

1. Si l'on fondait en Angleterre une école exclusivement destinée à fournir des officiers pour l'Artillerie et le Genie, quelle serait, d'après l'expérience faite par la France, la somme des connaissances exigibles?

Indépendamment de l'instruction que reçoit toute personne qui a suivi les cours professés dans les Colléges, il y a lieu d'exiger que les élèves d'une pareille école aient au moins des connaissances assez notables en mathématiques spéciales, en mécanique, en géodésie, en physique, et en chimie.

2. Quelle est selon vous la somme des connaissances mathématiques qu'on doit exiger des officiers appartenants à ces deux corps pour l'accomplissement habituel de leurs fonctions?

Les deux corps ont, indispensablement, besoin d'avoir des notions assez étendues, en mathématiques, en mécanique, et en géométrie descriptive, pour pouvoir résoudre les questions inhérentes aux fonctions d'officiers d'Artillerie et du Génie. Certaines parties de la chimie doivent être plus particulièrement familières aux officiers de la première de ces armes, et la seconde doit, en raison du service qui lui est attribué, posséder plus spécialement des connaissances physiques. Enfin, les officiers du Génie doivent posséder la géodésie et être aptes à toutes les opérations de levers.

As to any differences between the Artillery and Engineers.

3. En France, l'Ecole Polytechnique donne des Officiers à l'Artillerie et au Génie. Exige-t-on des connaissances mathématiques, ou autres, plus avancées pour un corps que pour l'autre?

Les connaissances exigées pour les élèves de l'Ecole Polytechnique sont exactement les mêmes pour tous, soit qu'ils sortent dans l'Artillerie ou dans le Génie. Avec l'organisation de nos écoles il est convenable qu'il en soit ainsi.

4. Offre-t-on aux élèves des avantages pécuniaires ou d'autres pour les engager à choisir un corps plutôt que l'autre?

Aucun avantage pécuniaire ou autre n'est offert aux élèves, pour les engager à prendre un service plutôt qu'un autre. Les élèves sont seulement influencés, soit par leurs goûts particuliers, soit par l'idée qu'il est plus avantageux d'entrer dans l'une plutôt que dans l'autre arme.

Il s'établit, par là, une concurrence qui est heureuse au point de vue des connaissances que les élèves acquièrent pour être en mesure de bien passer les examens d'après lesquels se fait le classement définitif des élèves, par ordre de savoir et de demande.

As to the union of the two Corps.

5. Croyez-vous qu'il soit désirable, ou non, à l'égard de leur instruction, et plus tard utile aux services publics, que l'Artillerie et le Génie soient réunis en un même corps.

La question de savoir si l'Artillerie et le Génie doivent être réunis en un seul corps, est tout-à-fait spéciale au pays dans lequel on se trouve. Ainsi, en France, où l'armée est nombreuse, où il y a un grand nombre de places fortes, où le corps du Génie est chargé du casernement de la troupe et de tous les bâtiments nécessaires aux divers services de l'administration militaire, ce corps a des fonctions assez importantes et des occupations assez variées pour être, tant en paix qu'en guerre, complètement distinct du corps d'Artillerie.

La réunion de ces deux armes a été, cependant, plusieurs fois agitée en France. Peut-être à côté des avantages de détail qu'elle pourrait offrir, se produirait-il des inconvénients. Cette idée n'est plus à l'ordre du jour.

Eu égard à la position géographique de l'Angleterre, si surtout le Génie militaire n'est pas chargé, dans les nombreuses colonies de la Grande Bretagne, des travaux d'organisation de défense de ces colonies, et des travaux exigés par les besoins des populations de ces localités, peut-être y aurait il avantage à fondre le corps du Génie avec celui de l'Artillerie. Cette question est assez complexe pour qu'on ne puisse la résoudre que dans le pays même intéressé à en avoir la solution.

Effects on the two Corps of the system of taking pupils from the Polytechnic.

6. Pensez-vous que dans l'Artillerie et le Génie Français il y ait trop de connaissances théoriques en comparaison des connaissances pratiques des officiers? Et s'il en est ainsi, en faites vous remonter la cause à l'influence de l'Ecole Polytechnique, ou bien y assignez vous toute autre cause?

A l'Ecole Polytechnique on voit plus de matières qu'il n'en faut, pour être officier d'Artillerie ou du Génie; mais il n'y a qu'avantage à cela, car les exigences du service conduisent, naturellement, à perdre de vue une partie des études faites précédemment, et il en résulte qu'au bout de quelques années on ne se trouve plus chargé que du bagage nécessaire au service que l'on doit remplir.

Quant à la facilité que la théorie donne, pour acquérir les connaissances pratiques voulues par la fonction dévolue à chaque élève sortant de l'Ecole Polytechnique, elle est incontestable.

7. Croyez-vous que le service de l'Artillerie et du Génie fût affecté avantageusement, ou désavantageusement, si l'admission des jeunes gens à l'Ecole d'Application à Metz dépendait simplement d'un examen sévère et du concours, sans exiger qu'ils eussent suivi un cours d'instruction théorique dans une des écoles de sciences spéciales ?

Probable effects of sending pupils direct to a School of Application without a previous theoretical course.

Il paraît certain que, pour la France, le personnel chargé de l'instruction dans les divers colléges, ne saurait permettre d'enseigner assez complètement aux élèves de ces colléges, les matières du programme des cours de l'Ecole Polytechnique, pour que l'on pût espérer, si cette école n'existait pas, d'avoir, par le concours direct, un nombre de jeunes gens suffisan , aussi instruits que le sont les élèves aujourd'hui sortant de cette établissement, pour l'Ecole d'Application du Génie et de l'Artillerie à Metz.

D'un autre côté, ce n'est généralement qu'à 18 ans que les jeunes gens peuvent arriver à l'Ecole Polytechnique.

Si ces jeunes gens entraient directement à Metz, en admettant même une réduction dans l'instruction puisée actuellement à l'Ecole Polytechnique, il faudrait évidemment, au minimum, une année d'études pour acquérir ces connaissances ainsi réduites.

Dès lors, pour compenser l'avantage de l'instruction si supérieure de l'Ecole Polytechnique on n'aurait que le mince bénéfice de faire arriver directement a Metz les jeunes gens un an plus tôt, ce qui est bien peu de chose comparé au temps que les officiers doivent consacrer au service.

Je n'hésite pas à dire que je préfère l'état de choses actuel.

9. En admettant la fondation d'une école spéciale d'Artillerie et du Génie, quelles sont parmi les parties d'enseignement suivies actuellement à l'Ecole Polytechnique et imposées aux élèves qui se destinent à des services civils, celles qui pourraient être ou conservées ou retranchées ? En est-il d'autres, qu'on pourrait y ajouter ?

As to the effects of admitting to the Polytechnic pupils destined for the Civil Service.

Tous les cours enseignés à l'Ecole Polytechnique semblent nécessaires pour être en mesure de suivre avec fruit les leçons de l'Ecole d'Application, où on doit aller en sortant de l'Ecole Polytechnique. Cependant, il est possible de songer à modifier ces cours dans certaines limites, et c'est ce qui fait que de temps à autre, l'on change les programmes d'enseignement de l'Ecole Polytechnique, en tenant compte, d'une part, des observations suggérées par l'expérience et des progrès de chacune des branches d'instruction que l'on y professe.

10. Pensez-vous qu'il résulte des avantages particuliers de la réunion dans le régime d'un enseignement commun d'élèves destinés aux fonctions civiles et à la carrière militaire ?

Dans une même école, plus les concurrents sont nombreux, plus il y a de chances pour que la moyenne d'instruction soit élevée. Les professeurs de l'Ecole Polytechnique sont, en général, des célébrités en France, et si plusieurs écoles étaient substituées à cette institution unique dans son genre, on aurait les plus grandes difficultés pour tenir l'enseignement au niveau actuel, faute surtout de professeurs aussi capables que ceux qui se trouvent groupés dans cette seule école.

Malgré les instincts militaires du pays, les élèves les plus forts de l'Ecole choisissent, en général, de préférence les parties civiles, Ponts et chaussées, et Mines. Il résulte de l'organisation de cette école qu'un certain nombre de jeunes gens qui ont pu entrer à l'Ecole Polytechnique avec l'espoir d'obtenir une partie civile, sont conduits à embrasser une carrière militaire, Etat-Major, Artillerie, Génie. Mais ces jeunes gens prennent bien vite le goût de leur nouvel état.

11. Dans l'hypothèse où nous recommanderions l'établissement d'une commission analogue au Conseil de Perfectionnement, quelles données l'expérience de l'Ecole Polytechnique fournirait-elle à l'appui de cette recommandation ?

As to the Board of Improvement.

Le Conseil de Perfectionnement se compose de membres choisis dans les différents corps qui s'alimentent à l'Ecole Polytechnique. C'est par ce moyen que cette école est reliée aux Ecoles d'Application, et c'est ce Conseil qui propose les modifications aux programmes de l'en-

seignement de l'Ecole Polytechnique, afin de donner satisfaction le mieux, et autant que possible, aux divers services intéressés.

La mission du Conseil de Perfectionnement est importante, et elle se lie essentiellement à l'institution de l'Ecole Polytechnique.

Paris, le 31 Mars, 1856.

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iii. Answers from Lieut.-Col. Favé.

From Lieut.-Colonel Favé.

As to the system of large professorial classes, adopted at the Polytechnic.

8. N'existe-t-il pas une grande différence sous le rapport des moyens et des connaissances acquises entre les jeunes gens de la première et de la dernière classe parmi les élèves admis à l'Ecole Polytechnique? N'éprouve-t-on pas de difficultés sérieuses, quand il s'agit de mettre les cours au niveau de tant d'intelligences et de capacités diverses? Le système de répétiteurs et d'interrogations particulières suffit il pour compenser cet embarras dans l'hypothèse d'une admission très nombreuse? Ce système laisse-t-il quelque chose à désirer, ou bien l'expérience acquise suggérerait elle quelques modifications?

Il existe sans doute une grande différence d'instruction entre les premiers et les derniers élèves de l'Ecole Polytechnique, mais il n'est pas rare que les derniers élèves s'acquittent aussi bien que les premiers de leurs fonctions dans la carrière où ils entrent. On n'éprouve pas de difficultés sérieuses pour mettre les cours au niveau d'intelligences et de capacités diverses, parceque tous les élèves sont éprouvés par un premier concours, le plus difficile de tous, celui de l'admission, et que tous ceux qui ne sont pas capables de grands efforts d'intelligence restent en chemin et n'arrivent pas à l'admission.

Ce qui caractérise l'Ecole Polytechnique et lui donne ses avantages c'est que fournissant d'abord aux jeunes gens le moyen d'acquérir par leur travail une carrière honorable, puis leur offrant en suite le choix entre plusieurs carrières, elle les excite pour l'admission et la sortie à des efforts extraordinaires: de là vient qu'il n'existe peut-être pas au monde d'auditoire aussi animé à l'étude et aussi intelligent que celui de l'Ecole.

Cette qualité distinctive de l'Ecolé a, suivant moi, conduit à l'abus, et les matières de l'enseignement ont été étendues outre mesure. L'amélioration à faire serait donc, d'après mon opinion, de diminuer ces matières du tiers ou du quart pour les faire mieux apprendre, surtout par les derniers, et aussi pour que les intelligences ne soient plus aussi fatiguées par un travail forcé.

As to the amount of the studies, pursued at the Polytechnic, required for Officers of the Artillery and Engineers.

9. En admettant la fondation d'une école spéciale d'Artillerie et du Génie, quelles sont parmi les parties d'enseignement suivies actuellement à l'Ecole Polytechnique et imposées aux élèves qui se destinent à des services civils, celles qui pourraient être ou conservées ou retranchées? En est-ild'autres, qu' on pourrait y ajouter?

En admettant la fondation d'une école spéciale d'Artillerie ou du Génie, il y aurait lieu, je crois, de supprimer la plus grande partie de l'enseignement donné à l'Ecole Polytechnique, parceque le stimulant puissant qui lui sert de base n'existerait plus. Je bornerais, en pareil cas, l'enseignement des mathématiques aux matières de l'admission; je supprimerais le cours d'analyse tout entier, une partie de la géométrie descriptive et de ses applications, presque tout le cours de mécanique, n'enseignant que les machines au point de vue expérimental; je supprimerais encore une partie des cours de physique et chimie, et presque tout le cours de géodésie. Il faudrait alors enseigner l'art militaire dans toutes ses branches, avec beaucoup plus de développement qu'on ne le fait à l'Ecole Polytechnique, et en traitant chaque question au point de vue de l'expérience avec beaucoup moins de considérations théoriques qu'on ne fait à l'Ecole d'Application de Metz.

Effects of admitting to the Polytechnic pupils destined for the Civil Service.

10. Pensez-vous qu'il résulte des avantages particuliers de la réunion dans le régime d'un enseignement commun d'élèves destinés aux fonctions civiles et à la carrière militaire?

L'avantage est celui de l'émulation qu'inspire l'importance du résultat à obtenir et il l'emporte beaucoup, suivant moi, sur les inconvénients incontestables, néanmoins, qui en résultent.

11. Dans l'hypothèse où nous recommanderions l'établissement d'une commission analogue au Conseil de Perfectionnement, quelles données l'expérience de l'Ecole Polytechnique fournirait-elle à l'appui de cette recommandation ?

As to the Board of Improvement.

Le Conseil de Perfectionnement n'est qu'une garantie donnée à chaque ministère qui recrute un ou plusieurs de ses services à l'Ecole. Chaque ministère exerce ainsi une surveillance pour empêcher qu'il ne soit fait à l'enseignement de l'Ecole des changements tournant à son détriment ; mais aussi chaque service lutte par ses représentants pour faire entrer dans l'enseignement le plus possible des matières jugées utiles aux siens ; de là vient que ces matières se sont étendues outre mesure, comme il a été dit précédemment.

1. Si l'on fondait en Angleterre une école exclusivement destinée à fournir des officiers pour l'Artillerie et le Génie, quelle serait, d'après l'expérience faite par la France, la somme des connaissances exigibles ?

As to the amount of knowledge required for Officers of the Scientific Corps.

La réponse se trouve en abrégé dans l'examen de la question 9 ; un long travail serait nécessaire pour la compléter.

2. Quelle est selon vous la somme des connaissances mathématiques qu'on doit exiger des officiers appartenants à ces deux corps pour l'accomplissement habituel de leurs fonctions ?

J'ai déjà répondu dans l'examen de la question 9, je n'aborderais ni le calcul différentiel et intégral, ni leurs applications.

3. En France, l'Ecole Polytechnique donne des Officiers à l'Artillerie et au Génie. Exige-t-on des connaissances mathématiques, ou autres, plus avancées pour un corps que pour l'autre ?

As to any differences between the Artillery and Engineers.

On donne les mêmes connaissances scientifiques aux uns qu'aux autres, et les différences qui existent à l'Ecole d'Application sont presque insignifiantes.

4. Offre-t-on aux élèves des avantages pécuniaires ou d'autres pour les engager à choisir un corps plutôt que l'autre ?

On n'offre aux élèves aucun avantage particulier pour les engager à choisir un corps plutôt que l'autre ; ils choisissent d'après leurs goûts ou par les considérations d'avancement plus ou moins rapide dans un corps que dans l'autre.

5. Croyez-vous qu'il soit désirable, ou non, à l'égard de leur instruction, et plus tard utile aux services publics, que l'Artillerie et le Génie soient réunis en un même corps ?

As to the union of the two Corps.

Je pense que dans un pays où les deux corps ne seraient pas trop considérables, il pourrait y avoir des avantages à leur réunion. La fortification, l'artillerie de place, la conduite des travaux de siège pourraient y gagner ; ces branches de l'art de la guerre ne devant pas être envisagées isolément, mais devant embrasser les considérations mixtes des deux services.

6. Pensez-vous que dans l'Artillerie et le Génie Français il y ait trop de connaissances théoriques en comparaison des connaissances pratiques des officiers ? Et s'il en est ainsi, en faites vous remonter la cause à l'influence de l'Ecole Polytechnique, ou bien y assignez vous toute autre cause ?

Effects on the two Corps of taking pupils from the Polytechnic.

Beaucoup d'esprits sont fatigués par l'Ecole Polytechnique et il leur reste peu d'ardeur au travail dans les écoles d'application ; à Metz, certaines connaissances sont peut-être présentées à un point de vue trop théorique et pas assez expérimental.

7. Croyez-vous que le service de l'Artillerie et du Génie fût affecté avantageusement, ou désavantageusement, si l'admission des jeunes gens à l'Ecole d'Application à Metz dépendait simplement d'un examen sévère et du concours, sans exiger qu'ils eussent suivi un cours d'instruction théorique dans une des écoles de sciences spéciales ?

Probable effects of sending pupils direct to a School of Application, without a previous theoretical course.

Je pense que les services de l'Artillerie et du Génie perdraient beaucoup, à la longue, par la suppression de l'Ecole Polytechnique. L'Artillerie surtout, à cause des nombreux établissements de genres variés qu'elle dirige et qui exercent une influence sur son service et sur celui des autres armes, a besoin, en France, qu'un certain nombre de ses officiers aient acquis une instruction étendue qui leur permette de se mettre promptement en

état de participer à la direction des établissements de l'industrie militaire. Cette considération est, comme on le voit, particulière aux états dont les officiers d'artillerie dirigent un grand nombre de ces établissements.

(Signed) Favé, Chef d'Escadron d'Artillerie,
Professeur d'Art Militaire à l'Ecole Polytechnique.

Paris, le 18 Mars, 1856.

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iv. Answers from M. Duhamel.

From M. Duhamel.

As to the system of large professorial classes.

8. N'existe-t-il pas une grande différence sous le rapport des moyens et des connaissances acquises entre les jeunes gens de la première et de la dernière classe parmi les élèves admis à l'Ecole Polytechnique? N'éprouve-t-on pas des difficultés sérieuses, quand il s'agit de mettre les cours au niveau de tant d'intelligences et de capacités diverses? Le système de répétiteurs et d'interrogations particulières suffit-il pour compenser cet embarras dans l'hypothèse d'une admission très nombreuse? Ce système laisse-t-il quelque chose à désirer, ou bien l'expérience acquise suggérerait elle quelques modifications?

Il y a sans doute une différence sensible entre la capacité des premiers et des derniers élèves admis à l'Ecole Polytechnique. Il-y-en-a aussi entre leurs connaissances acquises, mais elle est moins grande. Il se trouve toujours un bien plus grand nombre de candidats possédant suffisamment toutes les matières de l'examen, qu'il n'est possible d'en admettre. Il résulte de là que les cours de l'école peuvent être suivis par tous les élèves laborieux, n'ayant qu'une capacité ordinaire. Toutefois il faut que ces cours ne soient pas trop chargés, sans quoi les plus forts élèves eux-mêmes n'auraient pas le temps d'en digérer les matières, et les plus faibles seraient obligés d'en sacrifier quelques parts. Une partie de ces inconvénients se manifeste jusqu'à un certain point à l'Ecole Polytechnique. Le Ministre de la Guerre a demandé des réductions; et le Conseil de Perfectionnement en a bien peu proposé.

Les répétiteurs de l'Ecole Polytechnique sont chargés d'interroger les élèves en particulier, et de donner des numéros de mérite à leurs réponses. Ces numéros ont une certaine influence sur le classement, et par suite ces interrogations obligent les élèves à travailler, et à être constamment au courant. On pourrait y ajouter des séances dans lesquelles les répétiteurs recevraient tous les élèves qui auraient des difficultés à lever et des éclaircissements à demander sur les matières du cours. On y a bien pensé à l'Ecole Polytechnique; mais cela n'a jamais été réalisé convenablement.

As to the amount of the studies, pursued at the Polytechnic, required for Officers of the Artillery and Engineers.

9. En admettant la fondation d'une école spéciale d'Artillerie et du Génie, quelles sont parmi les parties d'enseignement suivies actuellement à l'Ecole Polytechnique et imposées aux élèves qui se destinent à des services civils, celles qui pourraient être ou conservées ou retranchées? En est-il d'autres, qu'on pourrait y ajouter?

Toutes les branches enseignées à l'Ecole Polytechnique me paraissent aussi utiles aux officiers du Génie et de l'Artillerie qu'aux ingénieurs civils. Mais mon opinion bien arrêtée, et résultant de vingt-huit années d'enseignement, d'examens, et de direction des études à l'Ecole Polytechnique, est que toutes ces branches sont trop chargées, et que les élèves ne peuvent en acquérir une connaissance suffisante. Il faudrait réduire les programmes à ce qu'il y a d'essentiel, de manière toutefois à ce que tous les grands principes pussent être parfaitement saisis et retenus. Ce sont eux qui disposent réellement aux applications, bien plus qu'une multitude de petits théorémes, et en quelque sorte, de recettes particulières. D'ailleurs ils agrandissent les vues et mettent en état de traiter avec plus de supériorité les questions nouvelles qui peuvent se présenter dans tous les services.

Il faut de plus faire faire aux élèves des applications des principes généraux à des questions variées, afin qu'ils s'assimilent les théories qui sans cela ne seraient que des abstractions vagues et presqu'inutiles. Le temps manque à l'Ecole Polytechnique pour faire un nombre suffisant de travaux de ce genre; et cependant il n'est que trop certain qu'on ne peut bien comprendre une méthode qu'en la mettant beaucoup en pratique. Il faut à la fois suivre des cours qui vous apprennent comment il faut procéder, et des recherches individuelles qui seules vous donnent des connaissances réelles et persistantes. Il faut donc

borner les matières enseignées et multiplier les applications intelligentes des méthodes.

"Cette limitation des programmes est la chose la plus difficile à bien faire; parcequ'il faut que tout ce qu'il y a d'important s'y trouve et rien d'inutile. Une commission me parait impropre à ce travail, vu que chacun cherche naturellement à developper la partie dont il fait sa specialité. Il faut confier ce soin à un seul homme, qui ait assez de raison pour consulter tous les hommes spéciaux, assez d'instruction et d'expérience pour juger ce qu'il entend; et qui presente définitivement un ensemble bien proportionné, et dont il ait la responsabilité morale."

11. Pensez-vous qu'il résulte des avantages particuliers de la réunion dans le régime d'un enseignement commun d'élèves destinés aux fonctions civiles et à la carrière militaire?

Effects of admitting to the Polytechnic pupils destined to the Civil Service.

Je crois qu'il y a des avantages précieux à donner un premier enseignement commun aux élèves, déjà un peu avancés, qui se preparent aux services militaires et au génie civil. L'expérience en est déjà longue en France, et vient à l'appui de ce principe. Il arrive souvent qu'il y ait des rapports entre ces divers services, et il est très utile que les hommes qui se trouvent en contact aient une origine commune, des théories semblables, et un langage scientifique commun. Il est bien plus difficile à un ingénieur sorti de l'Ecole Polytechnique de s'entendre avec celui qui est sorti de l'Ecole Centrale, ou de l'Ecole de St. Cyr, qu'avec l'ancien élève de l'Ecole Polytechnique, quelque carrière qu'il ait embrassée. Enfin la confraternité si puissante qui résulte de cette cohabitation, de cette communauté de travaux, de cette uniformité de costume qui efface toutes les distinctions autres que celles du caractère et du talent, produit des effets dont on ne saurait se dispenser de tenir compte, même au point de vue du service. L'esprit de corps qui s'établit inévitablement dans chaque branche particulière, est tempéré par l'esprit plus général qui se rapporte à leur berceau commun; et dans bien des circonstances graves, à la guerre comme dans la paix, on a eu l'occasion d'en sentir l'utilité. Je pense donc qu'il y a, pour des raisons très diverses, un avantage réel à enseigner dans une même école tout ce qui peut être également utile dans les armes savantes, et le génie civil; et d'envoyer en suite les élèves capables dans des écoles d'application différentes où ils s'adonnent spécialement à ce qui concerne la branche qui leur est échue.

11. Dans l'hypothèse où nous recommanderions l'etablissement d'une commission analogue au Conseil de Perfectionnement, quelles données l'expérience de l'Ecole Polytechnique fournirait-elle à l'appui de cette recommandation?

As to the Board of Improvement.

Je crois qu'il faudrait se borner à un Conseil d'Instruction composé des Professeurs et Examinateurs de l'Ecole, ainsi que de ses principaux Chefs. Ce conseil ferait tous les ans un rapport sur les résultats de l'enseignement, et proposerait les améliorations qu'il jugerait convenables. De leur côté les Ecoles d'Application feraient leurs observations sur ce qui manquerait à l'instruction des élèves qu'on leur enverrait; et d'après l'ensemble de ces demandes il serait facile de reconnaître les modifications qu'il conviendrait d'apporter aux études.

Un Conseil de Perfectionnement, composé comme à l'Ecole Polytechnique, des sommités des services publics, serait peut-être un obstacle grave avant qu'il puisse être formé des anciens élèves de la nouvelle Ecole. Il devrait donc s'écouler beaucoup de temps avant qu'on y songeât; et d'ailleurs ce que je viens de proposer me paraît suffire indéfiniment. Les chefs des services publics ne s'occupent plus depuis longtemps des matières qui sont l'objet des études de l'Ecole théorique; ils sont donc moins en état que les Professeurs d'apprécier les modifications qu'il y faut apporter, et l'utilité de certaines choses qui ne sont pas d'une application journalière, mais qui ont une influence importante sur la formation de l'esprit.

(Signé) J. M. A. Duhamel,

Membre de l'Institut, Ancien Directeur des Etudes de l'Ecole Polytechnique, actuellement Professeur à cette Ecole, et à la Faculté des Sciences de Paris.

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v. Answers from Two Staff Officers, introduced by a Letter from Lieut.-Colonel Claremont, C.B.

Some additional answers from two distinguished Staff Officers will be most suitably introduced by the letter from Lieutenant-Colonel Claremont, C.B., Her Majesty's Military Commissioner at Paris, by whose kindness they were obtained.

My Lord, Paris, 23rd May 1856.

When the Commissioners whom your Lordship sent over to this country, to study the system of French military education, went away, they left with me a set of questions which they begged I would put to those whom I considered best able to answer them. I have the honour to transmit herewith the answers of two very distinguished Staff Officers, whose opinions may be considered more impartial than those of either Artillery or Engineer Officers; they are both of them thoroughly versed in all military matters, and highly looked up to in the French army. I have placed their answers in juxta-position, as there is sometimes a curious difference between them.

I must add that *all* French Officers to whom I have spoken on the subject admit that, whatever may be our system of education, our Artillery Officers have proved themselves, all through the war, as most highly efficient, and thoroughly acquainted with every branch of their profession; in fact, they cannot praise them too much. They do not appear to have quite as good an opinion of our Engineer Officers, and attribute their shortcomings, if shortcomings there are, to our insular position, and consequent want of practice in fortification.

I have, &c.
(Signed) E. S. Claremont,
Lieutenant-Colonel.

The Right Hon. Lord Panmure, G.C.B.,
&c. &c. &c.

As to the system of large professorial classes.

Question A. N'existe-t-il pas une grande différence sous le rapport des moyens et des connaissances acquises entre les jeunes gens de la première et de la dernière classe parmi les éleves admis à l'Ecole Polytechnique? N'éprouve-t-on pas des difficultés sérieuses, quand il s'agit de mettre les cours au niveau de tant d'intelligences et de capacités diverses? Le système de répétiteurs et d'interrogations particulières suffit-il pour compenser cet embarras dans l'hypothèse d'une admission très nombreuse? Ce système laisse-t-il quelque chose à désirer, ou bien l'expérience acquise suggérerait elle quelques modifications?

Oui; dans mon opinion ces inconvénients existent. Les cours de l'Ecole Polytechnique sont tellement abstraits, que d'une part, ils ne sont pas à la portée de tous, et que, d'autre part, ils sont surabondants pour des jeunes gens destinés avant tout à faire des *hommes de guerre*, et non pas des hommes de science.

Cette différence n'est pas très grande et peu importante pour l'avenir des élèves dans les carrières qu'ils choisiront. Il faut nécessairement excepter quelques sujets d'élite. Il n'y a pas de difficultés réelles, les programmes étant faits pour les intelligences moyennes. Le système de répétiteurs, etc., suffit; excellent système qui a de tout temps fait la prospérité des études.

As to the amount of the studies, pursued at the Polytechnic, required for Officers of the Artillery and Engineers.

Question B. En admettant la fondation d'une école spéciale d'Artillerie et du Génie, quelles sont parmi les parties d'enseignement suivies actuellement à l'Ecole Polytechnique et imposées aux élèves qui se destinent à des services civils, celles qui pourraient être ou conservées ou retranchées? En est-il d'autres, qu'on pourrait y ajouter?

Question spéciale qui échappe en partie à ma compétence, et que je m'abstiens de résoudre.

On pourrait peut-être sans beaucoup d'inconvénients retrancher une partie des connaissances mathématiques enseignées a l'Ecole Polytechnique, les parties les plus ardues.

Effects of admitting to the Polytechnic pupils destined to the Civil Service.

Question C. Pensez-vous qu'il résulte des avantages particuliers de la réunion dans le régime d'un enseignement commun d'élèves destinés aux fonctions civiles et à la carrière militaire?

Il en résulte des inconvénients infinis.

Un avantage qui est sans prix, celui de l'emulation, chacun étant obligé de faire des efforts pour arriver à la carrière qu'il ambitionne.

Question D. Dans l'hypothèse où nous recommanderions l'établissement d'une commission analogue au Conseil de Perfectionnement, quelles données l'expérience de l'Ecole Polytechnique fournirait-elle à l'appui de cette recommandation ? As to the Board of Improvement.

Le Conseil de Perfectionnement est, je pense, une création très utile pour une école scientifique de premier ordre comme l'Ecole Polytechnique ; dans une école spéciale d'Artillerie et du Génie, ce conseil serait sans objet.

Le conseil doit être composé à la fois de membres qui connaissent les besoins des services publics et de membres qui aient assez de science pour discuter les programmes de l'enseignement intérieur.

1. Si l'on fondait en Angleterre une école exclusivement destinée à fournir des officiers pour l'Artillerie et le Génie, quelle serait, d'après l'expérience faite par la France, la somme des connaissances exigibles ? As to the amount of knowledge required for Officers of the Scientific Corps.

2. Quelle est selon vous la somme des connaissances mathématiques qu'on doit exiger des officiers appartenants à ces deux corps pour l'accomplissement habituel de leurs fonctions ?

C'est une question technique qu'il ne m'appartient pas de résoudre seul. L'intervention d'Officiers spéciaux bien choisis serait nécessaire.

Les connaissances exigibles seraient celles de l'Ecole Polytechnique, dont on pourrait retrancher, comme on l'a dit une partie des études théoriques les plus arduës.

Pour l'accomplissement *habituel* des fonctions des Officiers de l'Artillerie et du Génie, il ne faut que les connaissances mathématiques nécessaires pour les constructions, le dessin, et le levé des places.

3. En France, l'Ecole Polytechnique donne des Officiers à l'Artillerie et au Génie. Exige-t-on des connaissances mathématiques, ou autres, plus avancées pour un corps que pour l'autre ? As to any differences between the Artillery and Engineers.

Non ; les études sont les mêmes à l'Ecole Polytechnique, mais elles se spécialisent à l'Ecole de Metz.

Non.

4. Offre-t-on aux élèves des avantages pécuniaires ou d'autres pour les engager à choisir un corps plutôt que l'autre ?

Non.

Non ; ils se déterminent d'après leur aptitude et leur goût, ainsi que d'après les avantages qu'ils espèrent réaliser ; mais plusieurs, faute de places suffisantes dans les services qui sont l'objet de leur premier choix, entrent dans d'autres services qui sont moins de leur goût.

5. Croyez-vous qu'il soit désirable, ou non, à l'egard de leur instruction, et plus tard utile aux services publics, que l'Artillerie et le Génie soient réunis en un même corps ? As to the union of the two Corps.

La réunion de ces deux armes en une seule à déjà existé et a été abandonnée. Chacune d'elles a une mode d'action trop complexe et étendue pour que, dans une foule de circonstances, l'activité, et l'intelligence des mêmes hommes y suffisent ; mais leur solidarité est trop réelle pour qu'il n'y ait pas de grands avantages à leur donner une origine et, jusqu'à un certain point, des études communes.

La réunion des corps de l'Artillerie et du Génie aurait quelques avantages, mais serait contraire au principe de la division du travail ; chacun de ces services comprend déjà bien des détails.

6. Pensez-vous que dans l'Artillerie et le Génie Français il y ait trop de connaissances théoriques en comparaison des connaissances pratiques des officiers ? Et s'il en est ainsi, en faites vous remonter la cause à l'influence de l'Ecole Polytechnique, ou bien y assignez vous toute autre cause ? Effects on the two Corps of taking pupils from the Polytechnic.

Oui, oui ; la somme de connaissances abstraites que nous exigeons

Les opinions sont divisées à cet égard ; les uns pensent, et c'est l'opinion

pour l'admission à cette Ecole et pour l'entrée dans les services des mines, ponts et chaussées, &c., est beaucoup trop étendue pour ceux de nos jeunes gens qui aboutissent de gré où de force à l'Artillerie et au Génie. Leur cerveau fatigué d'études mathématiques compliquées, leurs vues incessamment dirigées vers l'abstraction, ne redescendent pas facilement à terre, à la terre des études et des travaux *pratiques*, lesquels sont en définitive, ceux qui sont nécessaires au jour de la lutte en campagne, dans une armée assiégeante ou dans une place assiégée.

qui a prévalu, que les connaissances théoriques enseignées à l'Ecole, sont la meilleure base possible pour les connaissances pratiques que les jeunes gens doivent acquérir plus tard; les autres prétendent que ces théories détournent une partie des jeunes gens, dans les premiers temps du moins et sans utilité (sauf quelques rares exceptions), des voies de la pratique, qui sont celles qui importent le plus au bien général du service de l'Etat.

7. Croyez-vous que le service de l'Artillerie et du Génie fût affecté avantageusement, ou désavantageusement, si l'admission des jeunes gens à l'Ecole d'Application à Metz dépendait simplement d'un examen sévère et du concours, sans exiger qu'ils eussent suivi un cours d'instruction théorique dans une des écoles de sciences spéciales?

Pour le bon et utile recrutement d'un corps d'Officiers d'Artillerie et du Génie, une école spéciale serait nécessaire et suffirait. Si nous étions aux prises avec les difficultés d'une guerre, de quelque durée, nous arriverions invinciblement en France à l'adoption de ce système dont nous avons fait usage autrefois en ce qui concerne les Officiers d'Artillerie, que l'Ecole Militaire de St. Cyr a fournis pendant un certain temps. C'est la paix succédant a nos dernières guerres qui a fait abandonner cette disposition. Toutefois je reconnais que l'Artillerie et le Génie, *considérés théoriquement*, reposent sur des données scientifiques d'un ordre très élevé qui exigent, pour être conservées et développées, l'intervention d'hommes livrés aux études les plus abstraites. Je pense qu'il serait utile qu'une catégorie spéciale d'Officiers ayant l'Ecole Polytechnique pour origine, et auxquels on ferait des avantages particuliers, fût chargée de maintenir la théorie de l'Artillerie et du Génie à la hauteur du progrès journalier des sciences sur lesquelles cette théorie repose. Dans notre système actuel, l'Ecole d'Application de Metz est le correctif de l'Ecole Polytechnique, et les Officiers qui en sortent sont généralement à la hauteur de leur mission; mais je maintiens que, pour arriver au but, nous suivons une route de traverse et pleine de complications, au lieu d'y marcher promptement et sûrement par la ligne droite.

Paris, le 23 Mai 1856.

On entre à l'Ecole Polytechnique à la suite d'examens sévères par la voie du concours, et cependant les épreuves incessantes et parfaitement comparatives subies à cette Ecole modifient beaucoup le classement d'entrée. Il en résulte pour la sortie de l'Ecole Polytechnique et l'entrée dans les Ecoles spéciales un classement tout différent, que l'on regarde comme mieux en rapport avec le mérite réel des élèves; par conséquent, l'admission directe à l'Ecole d'Application par voie de concours, ne donnerait pas la même garantie pour le classement; de plus en donnant par l'institution de l'Ecole Polytechnique une origine commune aux fonctionnaires d'un bon nombre des services publics, on obtient entre les individus une confraternité qui facilite les relations, contribue à aplanir les difficultés d'un service à l'autre, et n'est pas sans utilité pour l'Etat.

THE SPECIAL MILITARY SCHOOL AT ST. CYR.

General Description. Conditions of Admission. Staff.

Education of Officers for the Infantry and Cavalry.

It will have been seen in the accounts of the Polytechnic School and the School of Application at Metz, in what manner young men destined for commissions in the Artillery and Engineers receive their previous education, and under what conditions appointments as Officers in these two services are made in France. The regulations for the Infantry, the Cavalry, and the Marines are of the same description. There are in these also the same two ways of obtaining a commission. One, and in these services the more usual one, is to rise from the ranks. The other is to pass successfully through the School at St. Cyr. Young men who do not enter as privates prove their fitness for the rank of Officers by going through the course of instruction given, and by passing the examinations conducted in this, the principal, and putting aside the School of Application at Metz, the one Special Military School of the country.

Early foundations for military education established in France.

The Ecole Royale Militaire in 1751.

The earliest foundation of the kind in France was the Ecole Royale Militaire of 1751.* Like most other similar institutions of the time, it was intended for the young nobility. No one was to be admitted who could not prove four generations of *Noblesse*. The pupils were taught free of charge, and might enter at eight years old. Already, however, some marks of competition are to be discerned, as the best mathematicians were to be taken for the Artillery and Engineers. Buildings on the Plain of Grenelle (the same which still stand, occupying one end of the present Champs de Mars, and retaining, though only used as barracks, their ancient name), were erected for the purpose. The school continued in this form till 1776, when it was dissolved (apparently owing to faults of discipline), and replaced by ten Colleges, at Sorrèze, Brienne, Vendôme, and other places, all superintended by ecclesiastics. A new Ecole Royale Militaire, occupying the same buildings as the former, was added in 1777.

The ten Colleges.

The Ecole de Mars.

This came to an end in 1787; and the ten colleges were suppressed under the Republic. A sort of Camp School on the plain of Sablons took their place, when the war had broken out, and lasted about a year under the name of the Ecole de Mars.

The Prytanée Français in 1800.

Under the Consulate in 1800, the Prytanée Français was founded, consisting of four separate Colleges. The name was not long after changed to the Prytanée Militaire; and after some time the number was diminished, and La Flèche, which had in 1764 received the youngest pupils of the old Royal Military School, became the seat of the sole remaining establishment; which subsequently sunk to the proportions of a mere junior preparatory school, and became, in fine, the present establishment for military orphans, which still retains the title, and is called the Prytanée Militaire de la Flèche.

Origin of St. Cyr.

A *special* Military School in the meantime had been set up at Fontainebleau in 1803, transferred in 1808 to St. Cyr, and thus taking the place of the Prytanée Militaire and of its predecessor, the original Ecole Royale Militaire, gradually assumed its present form.†

Duration of course and Conditions of admission.

The course of study lasts two years; the usual number of cadets in time of peace is five, or at the utmost six hundred; the admission is by competitive examination, open to all youths, French by birth or by naturalization, who on the 1st of January preceding their candidature were not less than sixteen and

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* We are indebted for the earlier part of this account to the kindness of M. Terquem, Member of the Institute, the well-known librarian at the Depôt Central d'Artillerie. The later particulars are given from Vauchelle. M. Terquem's memoir will be found in Appendix L.

† Foundation of the Ecole Royale Militaire, 1751. The junior pupils are transferred to La Flèche, 1764.
Suppression of the Ecole Royale Militaire and establishment of ten Colleges, 1776.
New Ecole Royale Militaire, for the best pupils of the Colleges, 1777.
Suppression of the Colleges and of the Ecole Royale Militaire, 1787 . . . . .
Foundation of the Ecole de Mars, May 1794.
Foundation of the Prytanée Français at Paris, Versailles, Saint Germain, Fontainebleau, 1800.
Foundation of the Ecole Spéciale Militaire at Fontainebleau, 1803.
The four Schools of the Prytanée Français are converted into the Prytanée Militaire, 1806; and are transferred to La Flèche, 1808.
The Ecole Spéciale Militaire is transferred to St. Cyr, also in 1808.

not more than twenty years old. To this examination are also admitted soldiers in the ranks between twenty and twenty-five years of age, who, at the date of its commencement, have been actually in service in their regiments for two years.

The general conditions and formalities are the same as those already stated for the Polytechnic. It may be repeated that all the candidates, in accordance with a recent enactment, must have taken the usual degree which terminates the task at the *lycées*—the baccalaureat in sciences.

Engagement to serve seven years.

Those who succeed in the examination and are admitted, take an engagement to serve seven years either in the Cavalry or Infantry, and are thus under the obligation, if they are judged incompetent at the close of their two years' stay at the school to receive a commission, to enter and serve as common soldiers. The two years of their stay at the school counts as a part of their service. It is only in the special case of loss of time caused by illness, that permission is given to remain a third year.

Payment, and admission without payment.

The ordinary payment is 60*l.* (1,500 francs) per annum. All whose inability to pay this amount is satisfactorily established, may claim, as at the Polytechnic, an allowance of the whole or of half the expenses from the State, to which may be added an allowance for the whole or for a portion of the outfit (from 24*l.* to 28*l.*) These *bourses* or *demi-bourses*, with the *trousseau*, or *demi-trousseau*, have during the last few years been granted unsparingly. One-third of the 800 young men at the school in February 1856 were *boursiers* or *demi-boursiers*. Candidates admitted from the Orphan School of La Flèche, where the sons of officers wounded or killed in service receive a gratuitous education, are maintained in the same manner here.*

Cavalry department.

It was the rule till lately that cadets appointed, on leaving St. Cyr, to the Cavalry should be placed for two years at the Cavalry School at Saumur. This, however, has recently been changed; on entering St. Cyr those who desire appointments in the Cavalry declare their wishes, and are put at once through a course of training in horsemanship. Those who are found unfit are quickly withdrawn; the remainder, if their place on the final examination allows of their appointment to the Cavalry, are by that time sufficiently well-practised to be able to join their regiments at once.

Appointments to the Staff School.

Twenty-seven, or sometimes a greater number, are annually at the close of their second year of study placed in competition with twenty-five candidates from the Second Lieutenants belonging to the army,† if so many are forthcoming, for admission to the Staff School at Paris. This advantage is one object which serves as a stimulus to exertion, the permission being given according to rank in the classification by order of merit.

The School, a Battalion of eight companies.

The School consists of two Divisions, the Upper and the Lower, corresponding to the two years of the course. Each Division is divided again into four companies. In each of these eight companies there are sub-officers chosen from the *élèves* themselves, with the titles of *Sergent*, *Sergent Fourrier*, and *Caporal;* those appointed to the companies of the junior division are selected from the second year cadets, and their superiority in standing appears to give these latter some considerable authority, exercised occasionally well, occasionally ill. The whole school, thus divided into eight companies, constitutes one battalion.

The Establishment for conducting the School consists of—

Staff of Officers, Professors, &c.

A General as Commandant.
A Second in Command (a Colonel of Infantry).
A Major, 4 Captains, 12 Lieutenants, and 5 Second Lieutenants of Infantry; the Major holding the office of Commandant of the Battalion.
A Major, 1 Captain, 34 Lieutenants, and 3 Second Lieutenants of Cavalry to superintend the exercises, the riding, &c.
A Director of Studies (at present a Lieutenant-Colonel of Engineers).
Two Assistant Directors.
Six Examiners for Admission.

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* About twenty five are sent every year from La Flèche. The admissions from the army (*i. e.*, of soldiers between twenty and twenty-five years old) do not amount to more than four or at the utmost five per cent. They are very frequently young men who have previously failed for St. Cyr, and who then enter the army as privates, and come in as such. They have to pass the same examination.

† Few usually present themselves; and these also, it is said, are very generally old *élèves* of St. Cyr, who had not succeeded in obtaining admission to the Staff School before. They are not examined *with* the pupils of St. Cyr, but are intercalated in the list according to their merit.

One Professor of Artillery.
One Assistant ditto.
One Professor of Topography and Mathematics.
One Professor of Military Administration, Military Art, and Military History.
One Professor of Fortification.
One Professor of Military Literature.
Two Professors of History and Geography.
One Professor of Descriptive Geometry.
One Professor of Physics and Chemistry.
Three Professors of Drawing.
One Professor of German.
Eleven Military and six Civilian Assistant Teachers (*Répétiteurs*).

There is also a Quartermaster, a Treasurer, a Steward, a Secretary of the Archives, who is also Librarian, an Almoner (a Clergyman), four or five Surgeons, a Veterinary Surgeon, who gives lessons on the subject, and twelve Fencing Masters.

The professors and teachers are almost entirely military men. Some difficulty appears to be found by civilians in keeping sufficient order in the large classes; and it has been found useful to have as *répétiteurs* persons who could also be employed in maintaining discipline in the house. Among the professors at present there are several officers of the Engineers and of the Artillery, and of the Staff Corps.

Boards of Instruction and Discipline.

There is a Board or Council of Instruction, composed of the Commandant, the Second in Command, one of the Field Officers of the School Staff, the Director of Studies, one of the Assistant Directors, and four Professors.

So, again, the Commandant, the Second in Command, one of the Field Officers, two Captains, and two Lieutenants, the last four changing every year, compose the Board or Council of Discipline.

The Buildings.

St. Cyr is a little village about three miles beyond the town of Versailles, and but a short distance from the boundary of the park. The buildings occupied by the School are those formerly used by Madame de Maintenon, and the School which she superintended. Her garden has given place for the parade and exercise grounds; the chapel still remains in use; and her portrait is preserved in the apartments of the Commandant. The buildings form several courts or quadrangles; the Court of Rivoli, occupied chiefly by the apartments and bureaux of the officers of the establishment, and terminated by the chapel; the Courts of Austerlitz, and Marengo, more particularly devoted to the young soldiers themselves; and that of Wagram, which is incomplete, and opens into the parade grounds. These, with the large stables, the new riding school, the exercising ground for the cavalry, and the polygon for artillery practice, extend to some little distance beyond the limit of the old gardens into the open arable land which descends northwards from the School, the small village of St. Cyr lying adjacent to it on the south.

Courts of Rivoli, Austerlitz, Marengo, and Wagram.

General dispositions.

The ground floor of the buildings forming the Courts of Marengo, Austerlitz, and Wagram appeared to be occupied by the two refectories, by the lecture-rooms or amphitheatres, each holding 200 pupils, and by the chambers in which the ordinary questionings, similar to those already described in the account of the Polytechnic School, under the name of *interrogations particulières*, are conducted.

On the first floor are the *salles d'étude* and the *salle des collections*, the museum or repertory of plans, instruments, models, and machines, and the library; on the second floor the ordinary dormitories; and on the third (the attics), supplementary dormitories to accommodate the extra number of pupils who have been admitted since the commencement of the war.

Refectories.

The Commission, when visiting the School, was conducted on leaving the apartments of the Commandant to the nearest of the two refectories. It was after 1 o'clock, and the long room was in the full possession of the whole first or junior Division. A crowd of active and spirited-looking young soldiers, 400 at least in number, were ranged at two long rows of small tables, each large enough, perhaps, for 12; while in the narrow passage extending up and down the room, between the two rows, stood the officers on duty for the maintenance of order. On passing back to the corridor, the stream of the second year cadets was issuing from their opposite refectory. In the adjoining buttery, the loaf was produced, one kilogramme in weight, which constitutes the daily allowance. It is divided into four parts, eaten at breakfast, dinner, the afternoon lunch or

gouter, and the supper. The daily cost of each pupil's food is estimated at 1 f. 80 c.

Lecture Rooms, Museums, Library.

The Lecture-rooms and Museums offer nothing for special remark. In the library containing 12,000 books and a fine collection of maps, there were a few of the young men, who are admitted during one hour every day.

Salles d'Etude.

The *salles d'étude* on the first floor are, in contrast to those at the Polytechnic, large rooms, containing, under the present circumstances of the School, no less than 200 young men. There are, in all, four such rooms, furnished with rows of desks on each side, and overlooked in time of study by an officer posted in each to preserve order, and, so far as possible, prevent any idleness.

Dormitories.

From these another staircase conducts to the dormitories, containing one hundred each, and named after the battles of the present war—Alma, Inkerman, Balaclava, Bomarsund. They were much in the style of those in ordinary barracks. occupied by rows of small iron beds, each with a shelf over it, and a box at the side. The young men make their own beds, clean their own boots, and sweep out the dormitories themselves. Their clothing, some portions of which we here had the opportunity of noticing, is that of the common soldier, the cloth being merely a little finer.

Above these ordinary dormitories are the attics, now applied to the use of the additional 300 whom the School has latterly received.

Parade and Exercise Grounds, Riding Schools, Stables, &c.

The young men, who had been seen hurrying with their muskets to the parade ground, were now visible from the upper windows, assembled, and commencing their exercises. And when, after passing downwards and visiting the stables, which contain 360 horses, attended to by 200 cavalry soldiers, we found ourselves on the exercising ground, the cavalry cadets were at drill, part mounted, the others going through the lance exercise on foot. In the riding-school a squad of infantry cadets were receiving their weekly riding lesson. The cavalry cadets ride three hours a-day; those of the infantry about one hour a week. The exercising ground communicates with the parade ground; here the greater number of the young men were at infantry drill, under arms. A small squad was at field-gun drill in an adjoining square. Beyond this and the exercising ground is the practice ground, where musket and artillery practice is carried on during summer. Returning to the parade ground we found the cadets united into a battalion; they formed line and went through the manual exercise, and afterwards marched past; they did their exercise remarkably well. Some had been only three months at the School. The marching past was satisfactory; it was in three ranks, in the usual French manner.

Young men intended for the cavalry are instructed in infantry and artillery movements and drill; just as those intended for the infantry are taught riding, and receive instruction in cavalry, as well as artillery drill and movements.

It is during the second year of their stay they receive most instruction in the arms of the service to which they are not destined, and this, it is said, is a most important part of their instruction. "It is this," said the General Commandant, "that made it practicable, for example, in the Crimea, to find among the old *élèves* of St. Cyr, officers fit for the Artillery, the Engineers, the Staff; and for General Officers, of course, it is of the greatest advantage to have known from actual study something of every branch."

Vacation.

The ordinary School vacation last six or seven weeks in the year. The young men are not allowed to quit the grounds except on Sundays. On that day there is mass for the young men.

The routine of the day varies considerably with the season. In winter it is much as follows:—At 5 A.M. the drum beats, the young men quit their beds; in 12 minutes they are all dressed and out, and the dormitories are cleared. The *rappel* sounds on the *grand carré;* they form in their companies, enter their *salles*, and prepare for the lecture of the day until a quarter to 7. At 7 o'clock the officers on duty for the week enter the dormitories, to which the pupils now return, and at a quarter to 8 the whole body passes muster in the dormitories, in which, they have apparently by this time made their beds and restored cleanliness and order. Breakfast is taken at one time or other during the interval between a quarter to 7 and 8 o'clock.

They march to their lecture rooms at 8, the lecture lasts till a quarter past 9, when they are in like manner marched out, and are allowed a quarter of an hour of

amusement. They then enter the halls of study, make up their notes on the lecture they have come from, and after an hour and a half employed in this way, for another hour and a half are set to drawing.

Dinner at 1 is followed by recreation till 2. Two hours from 2 to a quarter past 4 are devoted to military services.

From 4 to 6 P.M. part are occupied in study of the drill-book (*théorie*), part in riding or fencing; a quarter of an hour's recreation follows, and from $6\frac{1}{4}$ to $8\frac{1}{2}$ there are two hours of study in the *salles*. At half-past 8 the day concludes with the supper.

Daily routine in summer.

The following table gives a view of the routine in summer:—

$4\frac{1}{2}$	A.M.	to	$4\frac{3}{4}$	A.M. Dressing.
$4\frac{3}{4}$	,,	to	$7\frac{1}{4}$	,, Military exercises.
$7\frac{1}{4}$	,,	to	$8\frac{1}{4}$	,, Breakfast, cleaning, inspection.
$8\frac{1}{4}$	,,	to	$9\frac{1}{2}$	,, Lecture.
$9\frac{1}{2}$	,,	to	$9\frac{3}{4}$	,, Recreation.
$9\frac{3}{4}$	,,	to	$11\frac{1}{4}$	,, Study.
$11\frac{1}{4}$	,,	to	1	P.M. Drawing.
1	P.M.	to	2	,, Dinner and recreation.
2	,,	to	4	,, Study of drill-book (*théorie*) or fencing.
4	,,	to	6	,, Study for some, riding for others.
6	,,	to	$6\frac{1}{4}$	,, Recreation.
$6\frac{1}{4}$	,,	to	8	,, Riding for some, study for others.
8	,,	to	$8\frac{1}{2}$	,, Supper.

Preparatory studies required for admission.

The Entrance Examination is much less severe than that for the Polytechnic; but a moderate amount of mathematical knowledge is demanded, and is obtained. The candidates are numerous; and if it be true that some young men of fortune shrink from a test, which, even in the easiest times, exacts a knowledge of the elements of trigonometry, and not unfrequently seek their commissions by entering the ranks, their place is supplied by youths who have their fortunes to make, and who have intelligence, industry, and opportunity enough to acquire in the ordinary *lycées* the needful amount of knowledge.

Present circumstances of the School.

Under present circumstances it is, perhaps, more especially in the preparatory studies that the intellectual training is given, and for the examination of admission that theoretical attainments are demanded. The state of the School in a time of war cannot exactly be regarded as the normal or usual one. The time of stay has been sometimes shortened from two years to fifteen months; the excessive numbers render it difficult to adjust the lectures and general instruction so as to meet the needs of all; the lecture rooms and the studying rooms are all insufficient for the emergency; and what is yet more than all, the stimulus for exertion, which is given by the fear of being excluded upon the final examination, and sent to serve in the ranks, is removed at a time when almost every one may feel sure that a commission which must be filled up will be vacant for him. Yet even in time of peace, if general report may be trusted, it is more the drill, exercises, and discipline, than the theory of military operations, that excite the interest and command the attention of the young men. When they leave, they will take their places as second lieutenants with the troops, and they naturally do not wish to be put to shame by showing ignorance of the common things with which common soldiers are familiar. Their chief incentive is the fear of being found deficient when they join their regiments, and, with the exception of those who desire to enter the Staff Corps, their great object is the practical knowledge of the ordinary matters of military duty. "Physical exercises," said the Director of Studies, "predominate here as much as intellectual studies do at the Polytechnic."

But the competition for entrance sustains the general standard of knowledge. Even when there is the greatest demand for admissible candidates, the standard of admission has not, we are told, been much reduced. No one comes in who does not know the first elements of trigonometry. And the time allotted by the rules of the School to lectures and indoor study is far from inconsiderable.

Examinations for Admission; Studies at the School.

The two Examinations for Admission.

The examinations for admission are conducted almost precisely upon the same system which is now used in those for the Polytechnic School.* There is a preliminary or pass examination (*du premier degré*), and for those who pass this a second or class examination (*du second degré*). For the former there are three Examiners, two for mathematics, physics, and chemistry, and a third for history, geography, and German. The second examination, which follows a few days after, is conducted in like manner by three examiners. A jury of admission decides. The examination is for the most part oral; and the principal difference between it and the examination for the Polytechnic is merely that the written papers are worked some considerable time before the first oral examination (*du premier degré*), and are looked over with a view to assist the decision as to admissibility to the second (*du second degré*). Thus the *compositions écrites* are completed on the 14th and 15th of June; the preliminary examination commences at Paris on the 10th July; the second examination on the 13th.

Subjects of Examination for Admission.

The Subjects of Examination are the following:—

Arithmetic, including vulgar and decimal fractions, weights and measures, square and cube root, ratios and proportions, interest and discount, use of logarithmic tables and the sliding rule.

Algebra to quadratic equations with one unknown quantity, maxima and minima, arithmetical and geometrical progressions, logarithms and their application to questions of compound interest and annuities.

Geometry, plane and solid, including the measurement of areas, surfaces, and volumes; sections of the cone, cylinder, and sphere.

Plane Trigonometry: construction of trigonometrical tables and the solution of triangles; application to problems required in surveying.

Geometrical representations of bodies by projections.

French compositions.

German exercises.

Drawing, including elementary geometrical drawing and projections; plan, section, and elevation of a building; geographical maps.

Physical Science (purely descriptive): cosmography; physics, including elementary knowledge of the equilibrium of fluids; weight, gravity, atmospheric pressure, heat, electricity, magnetism, acoustics, optics, refraction, microscope, telescope.

Chemistry, elementary principles of; on matter, cohesion, affinity; simple and compound bodies, acids, bases, salts, oxygen, combustion, azote, atmospheric air, hydrogen, water; respecting equivalents and their use, carbon, carbonic acid, production and decomposition of ammonia, sulphur, sulphuric acid, phosphorus, chlorine; classification of non-metallic bodies into four families.

History: History of France from the time of Charles VII. to that of the Emperor Napoleon I. and the treaties of 1815.

Geography, relating entirely to France and its colonies, both physical and statistical.

German: the candidates must be able to read fluently both the written and printed German character, and to reply in German to simple questions addressed to them in the same language.

Instruction at the School.

The general system of instruction at St. Cyr is similar to that of the Polytechnic; the lectures are given by the professors, notes are taken and completed afterwards, and progress is tested in occasional *interrogations* by the *répétiteurs*.† One distinction is the different size of the *salles d'étude* (containing 200 instead of 8 or 10); but, above all, is the great and predominant attention paid to the practical part of military teaching and training. It is evident at the first sight that this is essentially a military school, and that especial importance is attached both by teachers and pupils to the drill, exercise, and manœuvres of the various arms of the service.

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* The system was, in fact, first tried at St. Cyr, and adopted, on the representation of the Mixed Commission, at the Polytechnic. The previous method, by which different sets of examiners took different districts, had created distrust and dissatisfaction.

† Tables of the Employment of Time will be found in Appendix M.

Studies. Of the first year.

The course of study is completed in two years; that of the first year consists of—

27	lectures	in descriptive geometry.
35	„	physical science.
20	„	military literature.
35	„	history.
27	„	geography and military statistics.
30	„	German.
Total 174		

In addition to the above, there is a course of drawing between the time when the students join the school early in November and the 15th August.

Drawing.

The course of *drawing* consists in progressive studies of landscape drawing with the pencil and brush, having special application to military subjects, to the shading of some simple body or dress, and to enable the students to apply the knowledge which has been communicated to them on the subject of shadows and perspective. This course is followed by the second or junior division during the first year's residence.

Descriptive geometry.

The course of lectures in *descriptive geometry* commences with certain preliminary notions on the subject; refers to the representation of lines on curved surfaces, cylindrical and conical, surfaces of revolutions, regular surfaces, intersection of surfaces, shadows, perspective, vanishing points, &c., construction of geographical maps, and *plan côté*.

Physics.

The lectures in *physical science* embrace nine lectures on the general properties of bodies; heat, climate, electricity, magnetism, galvanism, electro-magnetism, acoustics.

There are twelve lectures in *chemistry;* on water, atmospheric air, combustibles, gas, principal salts, saltpetre, metallurgy, organic chemistry.

Mechanics.

There are fourteen lectures in *mechanics applied to machines;* motion, rest, gravity, composition and resolution of forces, mechanical labour, uniform motion, rectilinear and rotatory, projectiles in space, mechanical powers, drawbridges, Archimedean principle, military bridges, pumps, reservoirs, over and under shot wheels, turbines, corn mills, steam engines, locomotives, transport of troops, materials, and munitions on railways.

Military literature.

The 20 lectures in *military literature* refer to military history and biography, memoirs of military historians, battles and sieges, the art of war, military correspondence, proclamations, bulletins, orders of the day, instructions, circulars, reports and military considerations, special memoirs, reconnoissances and reports, military and periodical collections, military justice.

History.

The 35 lectures in *history* principally relate to France and its wars, commencing with the Treaty of Westphalia and ending with the Treaty of Vienna.

Geography.

The 27 lectures in *geography* and *military statistics* are subdivided into different parts; the first 8 lectures are devoted to Europe and France, including the physical geography and statistics of the same; the second 6 lectures are devoted to the frontiers of France; and the third part of 13 lectures to foreign states and Algeria, including Germany, Italy, Spain, Portugal, Poland, and Russia.

Of the second year.

The studies for the first division during the second year of their residence consist of—

10	lectures	in topography.
27	„	fortification.
15	„	artillery.
10	„	military legislation.
12	„	military administration.
27	„	military art and history.
20	„	German.
Total 121		

Drawing.

One lesson weekly is given in drawing, in order to render the students expert in landscape and military drawing with the pencil, pen, and brush.

We must not omit to call attention to the fact that mathematics are not taught in either yearly course at St. Cyr.

Topography.

The course in *topography*, of 10 lectures, has reference to the construction of maps, copies of drawings, theory, description, and use of instruments for measuring angles and levelling, the execution of a regular survey on the different systems of military drawing, drawing from models of ground, on the construction of topographical drawing and reconnoissance surveys, with accompanying memoirs.

Fortification.

Twenty-seven lectures are devoted to *fortification;* the first 13 relate principally to field fortification, statement of the general principles, definitions, intrenchments, lines, redoubts, armament, defilement, execution of works on the ground, means necessary for the defence, application of field fortification to the defences of *têtes de pont* and inhabited places, attack and defence of intrenchments, &c., castrametation; 6 lectures have reference

to permanent fortification, on ancient fortifications, Cormontaigne's system, exterior and detached works, considerations respecting the accessories of defence to fortified places; 8 lectures relate to the attack and defence of places, preparations for attack and defence, details of the construction of siege works from the opening of the trenches to the taking of the place, exterior works, as auxiliaries, sketches, and details of the different works in fortifications, plans and profile, &c.

The students also execute certain works, such as the making of fascines, gabions, saucissons, repair of revetments of batteries, platform, setting the profiles, defilement, and construction of a fieldwork, different kinds of sap, plan and establishment of a camp for a battalion of infantry, &c.

Artillery.

Under the head of *artillery*, fifteen lectures are given, commencing with the resistance of fluids, movement of projectiles, solution of problems with the balistic pendulum, deviation of projectiles, pointing and firing guns; small arms, cannon, materials of artillery, powder, munition, fireworks for military purposes; range of cannon, artillery for the attack or defence of places or coasts, field artillery, military bridges.

The students are practically taught artillery drill with field and siege guns, practice with artillery, repair of siege batteries, bridges of boats or rafts.

Military legislation.

The ten lectures allowed for the course of *military legislation* have for their object the explanation of the principles, practice, and regulations relating to military law, and the connexion with the civil laws that affect military men.

Military administration.

The twelve lectures on what is called *military administration* relate to the interior economy of a company, and to the various matters appertaining to the soldiers' messing, mode of payment, necessaries, equipment, lodging, &c.

Military art and history.

Military art and history is divided into three parts. The first, of five lectures, relates to the history of military institutions and organization. The second, of fifteen lectures, refers to the composition of armies and to considerations respecting the various arms, infantry, cavalry, état-major, artillery, and engineers, and the minor operations of war. The third part, of seven lectures, gives the history of some of the most celebrated campaigns in modern times. In the practical exercises, the students make an attack or defence of a work or of a system of fieldworks during their course of fortification, or of a house, farm, village, in the immediate vicinity of the school, or make the passage of a river.

German.

The students receive twenty lectures in *German*, and are required to keep up a knowledge of German writing.

Examinations at the School.

Examinations at the close of the first year.

The examinations at the end of the first year take place under the superintendence of the Director and Assistant Director of Studies. They are conducted by the Professor of each branch of study, assisted by a *Répétiteur*, each of whom assigns a credit to the student under examination, and the mean, expressed as a whole number, represents the result of the student's examination in that particular branch of study. The examination in military instruction for training (in drill and exercises) is carried on by the Officers attached to companies, under the superintendence of the Commandant of the Battalion, and that relating to practical artillery by the Officer in charge of that duty.

These, together with the marks obtained in the year, determine his position.

The pupils' position is determined, as at the Polytechnic, partly by the marks gained at the examination, partly by those he has obtained during his previous studies. In other words, the half of the credit obtained by a student at this examination in each subject is added to the half of the mean of all the credits assigned to him, in the same subject, for the manner in which he has replied to the questions of the Professor and *Répétiteur* during the year; and the sum of these two items represents his total credit at the end of the year. The scale of credit is from 0 to 20, as at the Polytechnic.

The minimum credit.

Every year, before the examinations commence, the Commandant and Second in Command, in concert with the Director and Assistant Director, and in concurrence with the Superior Officer commanding the battalion for military instruction, are formed into a Board to determine the amount of the minimum credit which should be exacted from the students in every branch of study. This minimum is not usually allowed to fall below eight for the scientific, and ten for the military instruction.

Any student whose general mean credit is less than *eight* for the scientific, or *ten* for the military instruction, or who has a less credit than *four* for any particular study in the general instruction, or of *six* for the military instruction, is retained at the School to work during the vacation, and re-examined about eight days before the re-commencement of the course, by a Commission composed of the Director and Assistant Director of Studies for the general instruction, and of the Second in Command and the Commandant of the Battalion, and of one Captain for the military instruction. A statement of this second examination is submitted to the Minister of War, and those students who pass

it in a satisfactory manner are permitted by him to proceed into the first division. Those who do not pass it are reported to the Minister of War as deserving of being excluded from the School, unless there be any special grounds for excusing them, such as sickness, in which case, when the fact is properly established before the Council of Instruction, they are permitted to repeat the year's studies.

Irregularity of conduct. Irregularity of conduct is also made a ground for exclusion from the School. In order to estimate the credit to be attached to the conduct of a student, all the punishments to which he can be subjected are converted into a specific number of days of punishment drill. Thus,

For each day confined in the Police Chamber - 4 days' punishment drill.
" " " Prison - - 8 " "

The statement is made out under the presidency of the Commandant of the School, by the Second in Command, and the Officer in Command of the Battalion. The credits for conduct are expressed in whole numbers in terms of the scale of 0 to 20, in which the 20 signifies that the student has not been subjected to any punishment whatever, and the 0, that the student's punishments have amounted to 200 or more days of punishment drill. The number 20 is diminished by deducting 1 for every 10 days of punishment drill.

Classification in order of merit. The classification in the order of merit depends upon the total amount of the sum of the numerical marks or credits obtained by each student in every branch of study or instruction. The numerical credit in each subject is found by multiplying the credit awarded in each subject by the co-efficient of influence belonging to it.

Co-efficients of influence for the various subjects. The co-efficients, representing the influence allowed to each particular kind of examination, in the various branches of study are as follows:—

Second Division, or First Year's Course of Study.

General Instruction.	Descriptive Geometry	Course	6	40
		Drawing and Sketches	2	
	Physical Science applied to the Military Arts.	Course	6	
		Sketch and Memoir	2	
	History		6	
	Geography and Statistical Memoirs.	Course	5	
		Sketch and Memoir	2	
	Literature, Memoir on		4	
	German		4	
	Drawing		3	
Special Instruction:—Drill, Practice, Manœuvres (Infantry and Cavalry)				7
Conduct				3
				50

First Division, or Second Year's Course of Study.

			Infantry.	Cavalry.	
General Instruction.	Topography	Course	3	3	32
		Maps, Memoirs, and Practical Exercises	3	2	
	Fortification	Course	4	4	
		Drawings, Memoirs, and Practical Exercises	3	2	
	Artillery and Balistic Pendulum	Course	4	4	
		Practical Exercises, School of Musketry	2	1	
	Military Legislation		2	2	
	Military Administration.	Course	3	3	
		Sheets of Accounts	1	1	
	Military History and Art.	Course	4	4	
		Memoirs and Applications	1	1	
	German		4	4½	
	Drawing		1	1	
Special instruction for	Infantry	Theory of Drill, Manœuvres—3 Schools	4		9
		Practical Instruction	3		
		Regulations	2		
	Cavalry	Riding		3	12
		Theoretical and Practical Instruction		7	
		Veterinary Art		2	
Conduct			6	6	
		Total	50	50	

Preliminary tables for ascertaining the credits due to each student.

To facilitate this classification in order of merit, three distinct tables are prepared,—

The first relating to the General Instruction;
The second relating to the Military Instruction; and
The third relating to the Conduct;

and they respectively contain, one column in which the names of the students are arranged by companies in the order in which they have been examined; followed by as many columns as there are subjects of examination, for the insertion of their individual credit and the co-efficient of influence, by which each credit is multiplied; and lastly by a column containing the sum of the various products belonging to, and placed opposite each student's name.

These tables are respectively completed by the aid of the existing documents, the first for the General Instruction, by the Director of Studies; the second for the Military Instruction, by the Officer commanding the Battalion; the third for Conduct, under the direction of the Commandant of the School, assisted by the Second in Command.

A Jury formed within the School, composed of the General Commandant, President, the Second in Command, the Director of Studies, and the Officer commanding the battalion, is charged with the classification of the students in the order of merit.

Arrangement in order of merit;

To effect it, after having verified and established the accuracy of the above tables, the numbers appertaining to each student in the three tables are extracted and inserted in another table, containing the name of each student, and, in three separate columns, the numbers obtained by each in General Instruction, Military Instruction, and Conduct, and the sum of these credits in another column.

By the aid of this last table, the Jury cause another to be compiled, in which the students are arranged in the order of merit as established by the numerical amount of their credits, the highest in the list having the greatest number.

If there should be any two or more having the same number of total credits, the priority is determined by giving it to the student who has obtained a superiority of credits in military instruction, conduct, general instruction, notes for the year; and if these prove insufficient, they are finally classed in the same order as they were admitted into the School.

and passage from the first to the second year.

A list for passing from the second to the first division is forwarded to the Minister at War, with a report in which the results for the year are compared with the results of the preceding year; and the Minister at War, with these reports before him, decides who are ineligible from incompetency, or by reason of their conduct, to pass to the other division.

Final examination before leaving.

The period when the final examinations before leaving the School are to commence, is fixed by the President of the Jury, specially appointed to carry on this final examination, in concert with the General Commandant of the School.

The President of the Jury directs and superintends the whole of the arrangements for conducting the examination; and during each kind of examination, a member of the corps, upon the science of which the student is being questioned, assists the Examiner, and, as regards the military instruction, each Examiner is aided by a Captain belonging to the Battalion.

Final Classification.

The examination is carried on in precisely the same manner as that already described for the end of the first year's course of study. And the final classification is ascertained by adding to the *numerical* credits obtained by each student during his second year's course of study, in the manner already fully explained, *one-tenth* of the numerical credits obtained at the examinations at the end of the first year.

The same regulations as to the minimum credit which a student must obtain in order to pass from one division to the other, at the end of the first year, which are stated in page 60, are equally applicable to his passing from the School to become a Second Lieutenant in the army.

Appointments made accordingly.

A list of the names of those students who are found qualified for the rank of Second Lieutenant is sent to the Minister at War, and a second list is also sent, containing the names of those students that have, when subjected to a second or revised examination, been pronounced by the Jury before whom they were re-examined as qualified.

Those whose names appear in the first list are permitted to choose according to their position in the order of merit, the staff corps or infantry, according to the number required for the first named service, and to name the regiments of infantry in which they desire to serve.

Those intended for the cavalry are placed at the disposal of the officer commanding the regiment which they wish to enter.

Those whose names appear in the second list are not permitted to choose their corps, but are placed by the Minister at War in such corps as may have vacancies in it, or where he may think proper.

The students who are selected to enter the staff corps, after competing successfully with the Second Lieutenants of the army, proceed as Second Lieutenants to the Staff School at Paris. Those who fail pass into the army as privates, according to the terms of the engagement made on entering the School.

THE SCHOOL OF APPLICATION FOR THE STAFF.

Duties of the French Staff.

Grades.

The Staff is the centre from which issue and to which are addressed all orders and military correspondence.

The Officers of the Staff are divided into Chiefs of the Staff, Sub-chiefs, Staff-officers, and Aides-de-camp.

The Colonels and Lieutenant-Colonels are employed as Chiefs of the Staff in the different military districts of France, and in the divisions of the army on active service. The ordinary posts of the Majors and Captains is that of Aides-de-camp to General Officers.

When several armies are united together under a Commander-in-Chief, the Chief of the General Staff takes temporarily the title of *Major-Général*, the General Officers employed under him that of *Aide-Major-Général.*

Duties of the Chief of the Staff.

The duties of the Chief of the Staff are to transmit the orders of the General; to execute those which he receives from him personally, for field-works, pitching camps, reconnoissances, visits of posts, &c.; to correspond with the Commanding Officers of the Artillery and the Engineers, and with the Commissariat, in order to keep the General exactly informed of the state of the different branches of the service; to be constantly in communication with the different corps, so as to be perfectly master of everything relating to them; to prepare for the Commander-in-Chief and for the Minister of War returns of the strength and position of the different corps and detachments, reports on marches and operations, and, in short, every necessary information.

The distribution of the other officers of different ranks, when it has not been made by the Minister of War, is regulated by the Chief of the General Staff.

Duties of Officers of the Staff.

In every division of the army an Officer of the Staff is specially charged with the office work, the others assist him when necessary, but they are more usually employed in general Staff duties, in reconnaissances, drawing plans of ground, missions, the arrangement of camps and cantonments, superintending the distribution of the rations, &c.

The Officers of the Staff may further be charged with the direction of field-works thrown up to cover camps and cantonments.

Staff Officers of all ranks may be employed on posts and detachments. On special missions they command all other officers of the same rank employed with them. When a Staff Officer is charged with the direction of an expedition or a reconnoissance, without having the command of the troops, the Officer in Command concerts with him in all the dispositions it may be necessary to make to ensure the success of the operation.

The Staff of Generals of Artillery and of Engineers is composed of Officers of their respective arms.

The War Depot.

The War Depot (*Dépôt de la Guerre*) was founded for the purpose of collecting and preserving military historical papers, reconnoissances, memoirs, and plans of battles; to preserve plans and MSS. maps useful for military purposes, and to have them copied and published.

Its object is to preserve all military papers,

It is divided into two sections—one charged with trigonometrical surveying, topography, plan drawing, and engraving; the other with historical composition, military statistics, the care of the library, the archives, plans, and maps. Each of these sections is under the direction of a Colonel of the Staff Corps, who has under his orders several officers of his corps.

and to prepare the Map of France.

The War Depot has taken a large share in the preparation of the map of France. The first idea of undertaking this important work dates from 1808. After various delays and difficulties, the trigonometrical survey, which had been for a time suspended, was recommenced in 1818. The work was placed under the War Depot, and entrusted to the Corps of Geographical Engineers. Since this period the Geographical Engineers have been incorporated in the Staff Corps, by the officers of which the work has been continued. The primary triangulation was finished in 1845; the secondary is now finished; the filling

in the details will occupy several years to come. The number of officers of the Staff Corps employed on the survey has varied from 26 to 90. Number employed on the survey.

The Staff Corps.

The Officers of the French Staff constitute a distinct and separate corps, numbering thirty-five Colonels, thirty-five Lieutenant-Colonels, 110 Majors, 330 Captains, and 100 Lieutenants. None but Officers of this corps can be employed on the Staff. When, by accident, there is not a sufficient number present, Regimental Officers may be temporarily employed, but they return to their Regiments as soon as Officers of the Staff Corps arrive to replace them. The division of the Staff into Adjutant-General's and Quartermaster-General's Department does not exist in the French service. Number of the Staff Corps.

The only means of entering the Staff Corps is through the Staff School of Application. Of the fifty student-officers which the School of Application usually contains, twenty-five leave annually to enter the Staff Corps, and are replaced by an equal number. Three of these come from the Polytechnic, the remaining twenty-two are selected from thirty pupils of the Military School of St. Cyr, who compete with thirty Second Lieutenants of the army, if so many present themselves; but, in general, the number of the latter does not exceed four or five. The only mode of admission to the corps is through the Staff School of Application.

The course of study in the Staff School of Application lasts two years. The students have the rank of Second Lieutenant. On passing the final examination they are promoted to the rank of Lieutenant; they are then sent to the Infantry to do duty for *two years*, at the expiration of which time they are attached for an equal period to the Cavalry. They may finally be sent for a year to the Artillery or the Engineers. After leaving the School, Officers do duty with the Infantry and Cavalry, with each for two years.

This routine cannot be interrupted except in time of war, and even then the Lieutenant cannot be employed on Staff duty until he has completed his *two years* with the Infantry. However, Officers who have a special aptitude for the science of geodesy or topography, may even earlier be employed on the map of France or other similar duty; and, further, two of the Lieutenants, immediately on quitting the Staff School of Application, are sent to the War Depot (*Dépôt de la Guerre*) to gain a familiarity with trigonometrical operations. Strictness of this rule.

The General Officers at their Inspections are required to report specially to the Minister of War on the Captains and Lieutenants of the Staff Corps doing duty with the Regiments in their districts, both as to their knowledge of drill and manœuvres, and their acquaintance with the duties of the Staff. They are to require these Officers to execute a military reconnoissance, never allowing more than forty-eight hours for the field sketch and its accompanying report. General Inspections.

Officers of all arms of the rank of Captain or under, are permitted to exchange with Officers of equal rank in the Staff Corps; but they must previously satisfy the conditions of the final examinations of the Staff College. Rights of Exchange.

The Buildings and Establishment.

The Staff School of Application is situated in Paris in the Rue de Grenelle, close to the Invalides. Of the ninety Officers attending it, sixty lodge in the building and thirty out of it, but all take their meals in the town. Each has, in general, a room to himself. Servants are provided in the proportion of one to about eight rooms. The Officers are forbidden to have private servants. Buildings.

The Staff of the School is composed as follows:— Establishment.

Seven officers.

- The Commandant, a General of Brigade.
- The Second in Command, Director of the Studies, a Colonel or Lieutenant-Colonel of the Staff Corps.
- A Major of the Staff Corps, charged with the superintendence of the interior economy and the drills and exercises.
- Three Captains of the same Corps, charged with the details of the interior economy of the School, and to assist the Major in the instruction of the Officers in their military duties. The Captains are required to take the direction of a portion of the topographical works on the ground.
- A Medical Officer.

Thirteen Military Professors, or Assistant Professors, viz.:— Thirteen Military Professors.

- A Major or Captain, Professor of Applied Descriptive Geometry.
- A Major or Captain, Professor of Astronomy, Physical Geography, and Statistics.

A Major or Captain, Professor of Geodesy and Topography.
A Major or Captain of Engineers, Professor of Fortification.
A Major or Captain of Artillery, Professor of the instruction relative to this arm.
A Military Sub-Intendant, Professor of Military Legislation and Administration.
A Major or Captain, Professor of Military Art.
A Captain, Assistant Professor of Descriptive Geography; charged also to assist the Professor of Fortification.
A Captain, Assistant Professor of Topography; charged also to assist the Professor of Geography.
A Major or Captain of Cavalry, Professor of Equitation; he acts under the immediate orders of the Major of the College.
Two Lieutenants or Second Lieutenants of Cavalry, Assistant Professors of Equitation.
An Officer of Cavalry of the same rank, acting as Paymaster to the Riding Detachment.

Five Civilian Professors.

The Non-Military Professors are:—

Two Professors of Drawing.
Two Professors of German.
A Professor of Fencing.

One hundred and forty-five horses are kept for the use of the student-officers and eighty-two men belonging to the Cavalry to look after them.

Both the studies and examinations at the Staff School hold an intermediate place between those of the Polytechnic and St. Cyr, being less abstract than the former, and higher and more difficult than the latter.

Conditions of Admission.—Entrance Examinations.

Entrance by competitive examinations, from the Polytechnic, St. Cyr, and the troops.

The entrance to the Staff School of Application in France is, as is the case in all the French Military Schools, by means of a competitive Examination, or, rather, by the results of three distinct Examinations, and by the selection of different sets of successful candidates. *Three* are taken from the students leaving the Polytechnic, who have an absolute right to the three first places in the Staff School, and *twenty-two* are selected from the thirty best students leaving St. Cyr, and an equal number of Sub-Lieutenants of the Line under twenty-five years of age, if so many present themselves. The Sub-Lieutenants must have one year of service in that rank, and they must make known their request to be allowed to compete for admission to the Staff School to the Inspector General, and, through him, to the Minister of War. It should be added, that their number is generally extremely small.

Sub-Lieutenants of the line compete.

Numbers admitted annually.

The usual number of young Officers admitted yearly to the School in time of peace is twenty-five, but this number is sometimes considerably exceeded, and we found no less than ninety present. The *three* Polytechnic students select the Staff School after their Final Examination, and the St. Cyr students make known their desire when the whole are examined by a Board of Examiners, and the thirty best are then selected as competitors for admission into the Staff School of Application.

The Sub-Lieutenants also repair to St. Cyr, where they are examined separately by the same Examiners who have just conducted the Examination of the St. Cyr students, and in the same subjects.

Their marks or credits are then compared with those of the St. Cyr pupils; and the relative positions of the two sets of candidates is ascertained, and the list of those to be admitted to the School of Application determined accordingly.

Conduct of the examination by a Commission of Examiners;

These Examinations take place before a Commission of Officers, composed of,—

A Lieutenant-General President, appointed by the Minister of War.
The Director or Chief of the Dépôt de la Guerre.
The Commandant of the School of Application.
Four Colonels or Lieutenant-Colonels of the Staff, appointed by the Minister of War.
A Field Officer chosen from among the Officers employed at the Dépôt de la Guerre, as permanent Secretary.

This Commission is also charged with drawing up and proposing regulations for the approval of the Minister of War concerning the interior organization and the course of study to be followed in the school, and to make changes in the programs for admission and for leaving the school. who suggest regulations for the School.

A very detailed account of the subjects of the entrance examination is drawn out, and inserted in the *Journal Militaire* and the *Moniteur* every year. The following are the subjects:— Subjects of Examination published yearly.

(1.) Trigonometry and Topography.
(2.) Regular Topography—the measuring of plane surfaces and levelling.
(3.) Irregular Topography, Plane Trigonometry.
(4.) Military Art and History, including—
  (*a.*) History of Military Institutions at the chief periods.
  (*b.*) Present composition of the French army.
  (*c.*) Organization of an army in the field.
  (*d.*) History of some of the most memorable campaigns, as those of 1796–97 in Italy, and of 1805 and 1809 in Germany.
(5.) Artillery and Science of Projectiles.
(6.) Field Fortification and Castremetation.
(7.) Permanent Fortification.
(8.) Military Legislation.
(9.) Military Administration.
(10.) Manœuvres.
(11.) German Language.
(12.) Drawing.

The marks assigned and the influence allowed to each of these subjects are the same as those given in the final examination at St. Cyr. The entrance examination places the students in order of merit.

The Studies.

All the details of the teaching are in the hands of a Council of Instruction, similar to that of the Polytechnic, and consisting of the General Commandant (President), the Director of Studies, and three Military Professors, appointed yearly by rotation. Other Professors and Assistant Professors, or Officers of the Staff of the School, may be called in to assist the Council, but (except in deciding the list at an examination) they have no votes. Plan of the Studies drawn up by a Council of Instruction,

This Council does not interfere directly with the administration, the common work of the School. It draws up, indeed, the list of lectures, making any alterations in them or in the books to be used which may seem from time to time desirable. But the officer accountable for the daily working of the School is the Director of Studies. His functions appeared to us to bring him into more constant connexion with the pupils than was the case with the Director of the Polytechnique. In all the schools the General Commandant and the Director of Studies live in the establishment; but at the *Ecole d'Application* and at St. Cyr the Director "examines the methods of teaching, and proposes "to the Council of Instruction any modifications or improvements which may "raise or quicken the instruction. He inspects the work of the student-"officers, both in and out of the school. He keeps a register of the marks "given by the Professors, and at the end of every three months brings the sum "of them before the General Commandant in a detailed report." In fact, his school functions are not modified, as at the Polytechnic, by a body of able Professors. carried out by the Director of Studies.

As already stated, there are fifteen Professors, without reckoning those of Equitation, and thirteen of them are Officers; but the system of *Répétiteurs*, which we have seen so influential at the Polytechnic, does not exist here. Means of Study.

The hours of work are, in summer, *i. e.* from May to November, from six to five, and in winter from eight to five, with the exception of one hour for breakfast and one hour for *étude libre*, which appears to mean very little indeed. From seven to nine hours daily may be taken as the amount, but (as is the case with most French schools) there is a constant change, not only in the subjects taught but in part of the work being *out* and part *in* doors, some really head work, much purely manual. There does not appear to be the same intense application as at the Polytechnic; indeed the work for three months in the year is almost entirely in the open air, consisting in making plans and military sketches, either in the neighbourhood of Paris or in the more distant parts of the country; eight months are devoted to the indoor studies, one month to the examinations. About eight hours of study daily.

The in-door studies are entirely conducted in the Halls of Study (*Salles*

Halls of Study.

d'étude), in each of which we found parties of twelve or fifteen students seated. They are inspected constantly by the Director or some of the Professors. None of the regular work may be done in private. It seems everywhere a fixed belief in the French Military Schools that very much would be done idly and ill if done in private. This presents a striking contrast to the feeling on the subject in England.

Nature and amount of the Studies.

The severer and preparatory studies of mathematics are supposed to have been completed prior to entrance into the Polytechnic or St. Cyr. Some, however, of the studies of applied science occupy considerable time at the School of Application.*

The following analysis will show the time assigned to each branch :—

Astronomy.

1. *Astronomy* occupies 1½ hours weekly for the pupils of the first year ; afterwards it ceases entirely.

Descriptive Geometry.

2. To *Applied Descriptive Geometry* a good deal of time is given, but still only by the pupils of the first year. 12 hours a-week are spent upon it in the first half-year, 10 in the second.

Topography.

3. *Military Topography* occupies about 10½ hours in the first year, 6 in the second.

Fortification.

4. A good deal of time is devoted to *Field Fortification.* The junior division, it is true, only begin it in their second half-year of study, and then only work at it for 1½ hours weekly. But the senior division are occupied 4½ hours weekly in their first half-year, and 7½ hours in their second.

Military Law.

5. *The Study of Military Administration and Legislation* is begun immediately upon entrance. It occupies during both years 1½ hours weekly.

Tactics.

6. *Lectures on Military Art and Tactics* are also given for 1½ hours weekly during both years, and after hearing these lectures the students are occasionally required to write a military memoir on a campaign, descriptions of reconnoissances, or of fields of battle, and to make sketches of ground with accompanying reports. This course was noted by General Foltz, the Director of the School, as defective, on the ground that it was too difficult to find a teacher for, or indeed to teach, military art ; and he thought that lectures on military history, or such works as Napoleon's Memoirs, would be more useful to the pupils.

Drawing.

7. *Drawing* occupies throughout 4½ hours weekly, and great attention is bestowed upon it. We were shown a large number of works done by the young officers of the School. To enumerate some of the most important—there were specimens of objects, with shadows ; perspective of the exterior and interior of buildings, with shadow s ; perspective views of country ; machinery drawings, plan, section, and elevation ; in fortification, a plan of comparison of a portion of ground with proposed field-works for defence ; military bridges ; reconnoissance, and memoir of a route, with accompanying notes and sketches, done both on foot and on horseback ; plan of a portion of country made with a compass by parties of ten, under the direction of a Captain (for this the trigonometrical points and distances were furnished, and it was filled up by a minor triangulation) ; plan of a field of battle, made without points ; and a description of the battle.

Journeys made for drawing.

These drawings were mostly executed with great care, and we were told that the course was fully as much as the student could accomplish in two years. Some parts of it are done entirely in the *Salles d'étude ;* sketches are made on horseback in the neighbourhood of Paris, always under the direction of the Professors, others again at great distances, such as one at Biarritz last year, and the one on which the pupils are to be engaged this year, is the line of operations of Wellington from the Spanish frontier to Toulouse. The two last kinds of work are roughly sketched, and finished at Paris. These summer occupations seem to stand in place of vacations, of which there are none.

Fencing

(1.) To *Fencing*, three hours a-week are given throughout.

Drill.

(2.) To the *Cavalry Drill* two hours weekly in the first division. It is replaced by *Infantry Drill* in the second.

The studies which none but the senior division pursue are,—

Artillery.

(1.) *Artillery* studies, which occupy 4½ hours weekly.

Geography.

(2.) *Geography*, meaning chiefly the military geography of a country, with a few lectures on statistics and political economy ; these take 1½ hours weekly.

Geodesy.

(3.) *Geodesy*, or trigonometrical surveying, also for 1½ hours.

The only strictly literary occupation is the study of German for about three hours per week during the whole time. We were told that a large proportion of the pupils unite among themselves to learn English privately, but no public course is given.

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* Tables of the Employment of Time are given in Appendix N.

The Examinations.

The students have two examinations to go through in each year; the first commencing about the first of June, the last in November, and each of the first year's examinations is held before a jury consisting of— The Two Examinations in each year.

(1.) The General Commandant, or the Director of Studies; President.
(2.) The Professor of the Course examined in.
(3.) Two Officers appointed by the Council of Instruction.

The last examination in each year is, of course, the most important, inasmuch as the passage from the Second or Junior to the First or Senior Division, and in part from the Senior into the Staff Corps is regulated by the results of these examinations; and the value allowed to the last examination in each year is just double of that assigned for the examinations in June.

The examinations of the first year are confined to the subjects of study followed during that year, viz.:— The First Year's Examinations.

Descriptive Geometry, Astronomy, Topography, Artillery, Fortification, Military Art and Administration, German, Drawing, Register of Notes and Memoranda.

The Professors and Members of the jury are directed rigorously to conform themselves to the following scale as regards the marks or credits they award for the oral answers, graphical representations, &c.

0 to 4 bad.
5 to 10 passable.
10 to 13 fair.
14 to 18 good.
19 to 20 very good.

The Co-efficients of influence of the various studies of the first year are as follows:— Co-efficients of influence in the First Year.

			Subdivision of the Co-efficients of the Graphical Representations.	
Descriptive Geometry	Theory - - - 4 Graphical Representation 3 Drawing of Machines. Memoir - 1 Drawing - 1	9	Survey with compass - - 1	6
Astronomy - -	Theory - - - 4 Graphical Representation 1	5	Rapid sketch - 1½ Itinerary of the first survey Itinerary of the second survey	1½
Topography - -	Theory - - - 4 Graphical Representation 6	10		
Artillery - - -	Theory - - -	4	First Topographical Drawing - ½ Second, with relief ¾ Third, on the scale of $\frac{1}{20000}$ - - ¾	
Fortification - -	Theory - - - 4 Graphical Representation 2 Memoirs - - - 2	8		
Military Art - -	Theory - - - 4 Memoirs: On various questions - 1 On surveys 2	7		
Military Administration	Theory - - - 4 Memoirs - - - 1	5		
Manœuvres - - - - - -		2		
German - - - - - -		4		
Drawing - - - - - -		2		
Keeping of Memorandum Books - - -		1		
Conduct and Discipline - - - -		1		
Riding and Knowledge of the Horse - - -		2	Riding Hippology	2
Total - - - -		60		

As soon as the examinations are concluded, the Council of Instruction prepares a provisory classified list of the students, made out in order of merit from the credits or marks awarded by the Examining Jury in connection with the above-mentioned co-efficients of influence, in a similar manner to that already explained in the account of the Polytechnic School, the student with the largest numerical credit being placed at the head of the list. Classification.

This provisory list is submitted to the Consulting Committee of the Staff Corps for transmission to the Minister of War.

In order to pass from the Second or Junior into the First or Senior Division, every Student Officer must have obtained the following marks or credits from the Jury, viz.:—

Conditions of Promotion to the Second Year.

In Astronomy and Geometry, six out of twenty in each.

In all other branches of theoretical instruction, four out of twenty.

In the classification of the graphical representations in Topography, a mean of eight out of twenty, and in each of the other courses a mean of six out of twenty; and as the general result of his various works and of his examinations (the mean of the year being combined with the number obtained before the jury in the proportion adopted by the Council of Instruction), he must have obtained a number of credits equal to one-half of the maximum (1,200).*

Every Student Officer who in his oral examination before the Jury has failed in obtaining the minimum stated above is subjected to a fresh proof before the Consulting Committee of the Staff Corps, and if this is not favourable to him he ceases to belong to the school, and must return to his regiment, unless such failure can be attributed to an illness of forty-five days, in which case he may be permitted to double his first year's course of study.

If the second proof be favourable he is retained at the school, but placed at the bottom of the classified lists prepared by the Council of Instruction.

The co-efficients of influence for the second year are—

Co-efficients of Influence in the Second Year.

			Subdivision of the Co-efficients of the Graphical Representations, &c.	
Geography and Statistics	Theory - 4 Memoir - 1	5		
Geodesy and Topography	Theory - 4 Graphical Representation - 6	10	Survey with the Compass - 1 Reconnoissance - 1½ Itinerary of the first survey - 1½ Itinerary of the reconnoissance - 1½ Drawing of a Fortress and its Environs - 1½ Reduction of the Drawings - ½	6
Artillery	Theory - 4 Graphical Representation - 3 Memoirs - 1	8	First Drawing of a Military Bridge - 1 Second ditto - ½ Breaching Battery - ½ Drawing of Artillery Carriage - 1	3
Fortification	Theory - 4 Graphical Representation - 3 Memoir on a Fortified Place - 2½ Memoir on a Project of Field Forrtification - 1½	11	Defilement - 1 Project of Fortification 2	3
Military Administration	Theory -	4		
Military Art	Theory - 4 Memoir on various questions comprised in drawing up a memoir - 2 Memoir on the survey with a Compass, or sketch reconnoissance - 2	8		
Manœuvres		3		
German		4		
Drawing		2		
Keeping of Note Books		1		
Conduct and Discipline		1		
Riding and Knowledge of the Horse		3	Riding - 2 Veterinary Art - 1	3
Total		60		

* It is not apparent in what manner these statements can be reconciled, inasmuch as the highest minimum exacted for any of the *separate studies* appears to be only *eight* out of twenty, or sensibly less than the *half*, and it is conceived that there must be some error in the printed regulations on the subject. (*Manuel Réglementaire à l'usage des Officiers élèves de l'Ecole d'Application du Corps Impérial d'Etat Major*, p. 48.)

Examination of the Second Year.

The examinations of the students of the Senior or First Division is made in a similar manner to that already described for the Junior Division, but after they are concluded, and prior to these students being admitted into the Staff Corps, they are subjected to another examination before the Consulting Committee of the Staff Corps, consisting of—

Examination before the Consulting Committee of the Staff Corps.

3 Generals of Division on the Staff.
3 Generals of Brigade.
3 Colonels of the Staff.
5 Lieutenant-Colonels, including the Secretary.

The Professors belonging to the school may be called in to assist at this examination, and when it is concluded the Consulting Committee proceeds to the definitive classification of the Student Officers of the First Division by causing the following documents to be placed before them, viz.:—

The register of the notes of each Student Officer.

Tables of the value of their work; the classified list of passage to the First Division, and the provisionary list for leaving, recently prepared by the Council of Instruction. The numerical credits obtained in these two classifications are added (each sum being halved) to the definitive classification prepared by the Committee. The total is divided by two, in order not to exceed the regulated limit of 1,200 credits for the maximum.

Results.

Every Student Officer who, in this examination for leaving, has not obtained the half of the maximum number of numerical credits is considered to be inadmissible to the Staff Corps.

This classified list, prepared by the Consulting Committee of the Staff Corps, fixes the position of the Student Officers in order of merit, and according to this order of merit they enter the Staff Corps. The Committee reports to the Minister of War the names of the Student Officers that are not eligible for the Staff Corps.

The first two or three places, we were told, are always remembered as marks of distinction, but the honour does not descend lower, as in the intense competition of the Polytechnic.

Students belonging to the First Division may also be permitted to double the second year's course of study on account of illness; but in no case can an Officer be permitted to remain more than three years at the school.

JUNIOR SCHOOLS, THE LYCEUMS AND PREPARATORY SCHOOLS.

Boys are prepared for the Military Schools at places of Civil Education.

Junior Military Schools for boys under the age of sixteen may be said no longer to exist, or at least to receive the support of the State in France. The various attempts to establish them before, during, and after the Revolution of 1789, have apparently been unsuccessful. The sole surviving monument of these endeavours is the *Collége* or *Prytanée Militaire* at La Flèche, a town a little north of Tours, which is now for the most part an Orphan School for the sons of Officers. Some details relating to the school will presently be given. But it is hardly a real exception; the instruction is not military; the pupils are not bound to enter the army; and though they do go in considerable numbers to St. Cyr, they also enter freely into other professions. St. Cyr and the Polytechnic are recruited in general from the common schools of the country.

Influence exerted by the Military on the Civil Schools.

Remark of General Poncelet.

But on the other hand, the Military Schools, and the Polytechnic more especially, exercise upon these common schools a most powerful influence. "This is my one piece of advice," said a distinguished French general, well known as a man of science, in conversation with us. "Fix your programme for admission at a high point; keep rigidly and uncompromisingly to it; reject all who do not reach it; and raise it gradually; preparation will be made accordingly; the pupils will say to their masters, 'this is required, teach us this,' and you will gradually raise the standard in all the preparatory schools in the country. So at least it has been in France." So certainly it does seem to have been. The standard in certain studies has been steadily elevated, while the importance of others has been gradually reduced; and, in fact, a complete revolution in the whole system has been effected.

The best pupils in the *Lycées* (the University Schools of France, corresponding to our Public and great Grammar Schools,) have long been looking forward, less to the prospects of the bar or of the church, as with us, than to admission at the Polytechnic, and large numbers of the less proficient have in like manner desired preparation for St. Cyr.* For this object the course of instruction at the *Lycées* was not very well designed. It soon became evident that to get in at the Polytechnic and St. Cyr less Latin and literature, and much more Algebra and Geometry, were wanted. Special schools to give this special instruction quickly sprung up, and boys were without hesitation removed from the *Lycées* to attend them. For the diploma of the Bachelor's degree (in France a certificate of the completion of the school studies) which at that time could only be got by attending the *Lycées*, was required for admission to the learned professions; but at St. Cyr and the Polytechnic it was not then required.

Gradual withdrawal of pupils from the *Lycées* to private preparatory Schools, the Bachelor's degree not having been required by the Military Schools.

Consequent change of system at the *Lycées*.

The subject had often been debated. Proposals had often been made to add this to the conditions of admission to the entrance examinations, but the amount of literary attainment required had always been a fatal objection. To obtain the diploma of science the previous diploma of arts was necessary; and to go through the studies demanded for this appeared to be a waste of time. The Scientific and Military Schools declined to alter their system; it was left to the *Lycees* to alter theirs.

The Decrees of April 10, 1852. The Bifurcation.

A new arrangement, popularly called the *Bifurcation*, was introduced by the Decrees of the 10th April 1852; and has now come into operation. The conditions demanded for the degree in science were adapted to the requirements of the Military Schools; and in return for this concession it is henceforth to be exacted from candidates for the Military Schools. The diploma of arts is no longer required before the diploma of science can be given. The instruction, which in the upper classes of the *Lycées* had hitherto been mainly preparatory for the former, takes henceforth at a certain point (called that of *Bifurcation*) two different routes, conducting separately, the one to the baccalaureat of arts, the other to that of science. The whole system of teaching has accordingly been altered. Boys wanting to study Algebra are no longer carried through a long course of Latin; mathematics are raised to an equality with literature; and thus military pupils,—pupils desirous of admission at the Polytechnic and St. Cyr,

* The *Ecole Normale*, which prepares Teachers and Professors, and the *Ecole Centrale* of Arts and Manufactures (a well-conducted School of Civil Engineering), have also, though in a less degree, been objects of similar ambition.

may henceforth, it is hoped, obtain in the *Lycées* all the preparation which they had latterly sought elsewhere.

Present routine at a *Lycée*; division of studies at the age of fourteen.

Under this new system the usual course for a boy seems to be the following:—He enters the *Lycée*, in the Elementary Classes; or, a little later, in the Grammar Classes, where he learns Latin and begins Greek. At the age of about fourteen, he is called upon to pass an examination for admission into the Upper Division, and here, in accordance with the new regulations, he makes his choice for mathematics or for literature, the studies henceforth being divided, one course leading to the bachelorship of science, the other to that of arts.

The new course leading from this point to the Bachelorship of Science,

In either case he has before him three yearly courses, three classes—the Third, the Second, and what is called the Rhetoric. At the close of this, or after passing, if he pleases, another year in what is called the Logic, he may go up for his bachelor's degree. The boy who wants to go to St. Cyr or the Polytechnic chooses, of course, the mathematical division leading to the diploma he will want, that of a bachelor of *science*. He accordingly begins algebra, goes on to trigonometry, to conic sections, and to mechanics, and through corresponding stages in natural philosophy, and the like. If he chooses to spend a fourth year in the Logic, he will be chiefly employed in going over his subjects again. He may take his bachelor's degree at any time after finishing his third year; and he may, if he pleases, having taken that, remain during a fifth or even a sixth year, in the class of Special Mathematics.

and giving preparation for St. Cyr and for the Polytechnic.

If he be intended for St. Cyr, he may very well leave at the end of his year in the Rhetoric, taking of course his degree. One year in the course of Special Mathematics will be required before he can have a chance for the Polytechnic. Usually the number of students admitted at the latter, who have not passed more than one year in the *mathematiques spéciales* is very small.* Very probably the young aspirant would try at the end of his first year in this class, and would learn by practice to do better at the end of a second.†

The *Proviseur* or Principal of the Lycée St. Louis, where great attention is paid to preparation for the scientific schools, spoke of a very large number of pupils (130) in his class of Special Mathematics, who would send in their names as candidates for the Polytechnic at the examination to be held in the coming August of 1856. In 1855 the number of candidates from the *Lycées* of Paris was 144; from private preparatory schools 133. For admission at St. Cyr, at the same date, there were from the *Lycées* at Paris only 70 candidates; from those in the departments immediately around Paris 30; and 170 from private preparatory schools.

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* For example, 39 out of 170 candidates.

† Studies of the Mathematical Section of the Upper Division, as laid down by the Order 30th August 1852.

The Third Class (*Troisième*), at fourteen years old.

Arithmetic and first notions of algebra. Plane Geometry and its applications; (*levé des plans*). First notions of Chemistry and Physics. General notions of Natural History; principles of classification. Linear and imitative Drawing (*dessin lineaire et d'imitation*).

The Second Class (*Seconde*), at fifteen years old.

Algebra; Geometry, figures in space, recapitulation; Applications of Geometry, notions of the geometrical representations of bodies by projections; Rectilineal Trigonometry; Chemistry; Physics; and Drawing.

The Rhetoric, at sixteen years old.

Exercises in Arithmetic and Algebra; Geometry; notions on some common curves; and general recapitulation; Applications of Geometry; notions of levelling and its processes; recapitulation of Trigonometry; Cosmography; Mechanics; Chemistry concluded and reviewed; Zoology and Animal Physiology; Botany and Vegetable Physiology; Geology; Drawing. (The pupil may now be ready for the Degree and for St. Cyr.)

The Logic, at seventeen years old.

Six lessons a week are employed in preparation for the bachelorship of science, and in a methodical recapitulation of the courses of the three preceding years according to the state of the pupils' knowledge.

Two lessons a week are allowed for reviewing the literary instruction; evening lessons in Latin, French, English, and German, and in History and Geography, having been given through the whole previous time.

The Special Mathematics, at eighteen and nineteen years old.

Five lessons a week are devoted to these studies; in the other lessons the pupils join those of the Logic class for reviewing all their previous subjects, whether for the bachelorship in science or for competition for admission at the *Ecole Normale* or the Polytechnic.

It appears that by the regulations a boy may enter the Special Mathematics without passing through the year of recapitulation in the Logic.

Beginning at about fourteen years old in the Upper Division, a boy would thus be sixteen or seventeen on taking his degree and about eighteen at his first attempt to be admitted at the Polytechnic.

The *Ecoles Preparatoires* are nevertheless still frequented.

These last statistics show that as yet the laws of 1852 have scarcely succeeded in bringing pupils back from the *Ecoles Préparatoires*. These schools have now the right, no longer confined to the *Lycées*, of preparing for the bachelor's degree. And the most famous of them, that of St. Barbe*, continues to furnish a large proportion of the successful candidates for the Polytechnic. On the last admission of 170, no less than 60 are said to have come from hence. And various similar schools, with the special object of preparing boys for St. Cyr, exist in the neighbouring town of Versailles. The Report of the Mixed Commission on the Polytechnic speaks unfavourably of these establishments in general, and quotes very strong expressions which had been used in reference to the artificial nature of the preparation given in them. Still, in public estimation the teaching is so far superior, or to such a degree more successful in attaining the object, that the expense of two or even three years' study in these classes, in preference to the Special Mathematics of the *Lycées*, appears to be very frequently incurred.

Method of teaching in the upper classes of the *Lycées*.

It will only be necessary to add a few sentences in explanation of the methods pursued in the upper classes of the *Lycées*. The classes are large—from 80 to above 100; the lessons strictly professorial; lectures, with occasional questions, as at the Polytechnic itself. In large establishments the class is divided, and two professors are employed, giving two parallel courses on the same subject. To correct and fortify this general teaching, we find, corresponding to the interrogations of the Polytechnic, what are here called conferences. The members of the large class are examined first of all in small detachments of five or six by their own professors once a week; and, secondly, a matter of yet greater importance, by the professor who is conducting the parallel course, and by professors who are engaged for this purpose from other *Lycées* and preparatory schools, and from among the *répétiteurs* of the Polytechnic and the Ecole Normale themselves. It appeared by the Table of the examinations of this latter kind which had been passed by the pupils of the class of Special Mathematics at the *Lycée* St. Louis, that the first pupil on the list had in the interval between the opening of the school and the date of our visit (February 16) gone through as many as twenty-four.

The assistants, who bear the name of *répétiteurs* at the *Lycées*, do not correspond in any sense to those whom we have already noticed at the Ecole Polytechnique. They are in the *Lycées* mere superintendents in the *salles d'étude*, who attend to order and discipline, who give some slight occasional help to the pupils, and may be employed in certain cases, where the parents wish for it, in giving private tuition to the less proficient. The system of *salles d'étude* appears to prevail universally; the number of the pupils placed in each probably varying greatly. At the Polytechnic we found, it will be remembered, eight or ten pupils in each; at St. Cyr as many as 200. The number considered most desirable at the Lycée of St Louis was stated to be 30.

The French junior schools have in general a military character.

It thus appears that in France not only do private establishments succeed in giving preparation for the military schools, but that even in the first-class public schools, which educate for the learned professions, it has been considered possible to conduct a series of military or science classes by the side of the usual literary or arts classes. The common upper schools are not, as they used to be, and as with us they are, *Grammar* schools, they are also *Science* schools. In every *Lycée* there is, so to say, a sort of elementary polytechnic department, giving a kind of instruction which will be useful to the future soldier, and at the same time to others, to those who may have to do with mines, manufactures, or any description of civil engineering. There is thus no occasion for Junior Military Schools in France, for all the junior schools are more or less of a military character.†

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* The School of St. Barbe is situated near the Pantheon. It has probably many foreign pupils. One of the candidates who gained an appointment to the Royal Artillery at the competitive examination held at Burlington House in January last, was educated there.

† The conditions of admission to the examination for the degree of Bachelor of Science are simply, sixteen years of age, and the payment of fees amounting to about 200 fr. (10*l*.) Examinations are held three times a year by the Faculties at Paris, Besançon, Bordeaux, Caen, Clermont, Dijon, Grenoble, Lille, Lyons, Marseilles, Montpellier, Nancy, Poitiers, Rennes, Strasburg, and Toulouse, and once a year at Ajaccio, Algiers, and nineteen other towns. There is a written examination of six hours, and a vivâ voce examination of an hour and a quarter. It is, of course, only a *pass* examination, and is said to be much less difficult than the competitive examination for admission to St. Cyr.

THE MILITARY ORPHAN SCHOOL AT LA FLECHE.

(*Prytanée Impériale Militaire de La Flèche.*)

Age of pupils.

The *Collége* or *Prytanée Militaire* appears, in point of studies, to differ from the schools that have just been described, chiefly in its having, so to say, only one department for the elder pupils, the scientific, with merely occasional subsidiary lessons in grammar and literature. As we did not visit it, the following details are merely repeated from Vauchelle's *Cours d'Administration Militaire*, and from the official *Instruction pour l'Admission* issued by the Ministry of War.

Course of study.

The institution is a school for boys between the ages of ten and eighteen; no one under ten or above twelve years old can be admitted: and no one can commence a new course at the school after completing his eighteenth year.

The prescribed instruction is said to comprise the following courses:—

Humanities (Latin, &c.)
History and Geography.
German.
Mathematics.
Physical Sciences.
Natural History.
Figure Drawing.
Linear Drawing.

And the general object of the courses is to qualify the pupils to pass the examination for the degree of Bachelor of Science.

The pupils also go through military and gymnastic exercises, and learn to swim.

Government and Staff.

The School is under military discipline, is governed by a General Officer of the Staff Corps or a Colonel in active service, as Commandant and Director of Studies, and by a Lieutenant-Colonel or Major, with the title and functions of Second in Command and Sub-Director. In addition there are four Officers, twenty-three Professors and Teachers, and eighteen *Répétiteurs*.

Charges, and conditions of free admission.

The yearly charge for paying pupils is 850 francs, and the cost of outfit about 500 francs; but there are 400 free and 100 half-free places (400 *bourses* and 100 *demi-bourses*) granted by the State in favour of the sons of Officers, the order of preference being regulated as follows, those who are orphans on both sides having the first claim, and those who have lost their father, the next:—

1. Those whose fathers have been killed, or have died of wounds received in action.
2. Those whose fathers have died in the service, or after retiring on a pension.
3. Sons of fathers who have been disabled in consequence of wounds received in action.

Sons of Non-commissioned Officers or of Private Soldiers who have been killed or have been disabled in action, who have been placed on the retired list, or have been discharged after twenty years' service, may also be admitted, as a special mark of favour.

Examination for admission.

The candidates undergo an examination, not, however, for the purpose of competition, but merely to show that they are qualified to enter the classes.

Annual inspection and course upon leaving.

The School is inspected annually by a General Officer sent by the War Department, as also by an Officer of the Commissariat. There is no sort of engagement or expectation that the pupils should enter the military service. The nature of the studies holds out some inducement to them to compete for admission at St. Cyr or the Polytechnic; and in the examination for entrance at St. Cyr, it is stated that the sons of military men have the privilege of being raised fifteen places in the list of the order of merit. An Officer's or Soldier's son from La Flèche would, in case of 300 candidates being admitted to St. Cyr, be able to claim admission, if he came 315th on the list, to the exclusion of the candidate who stood 300th.

SCHOOL OF MUSKETRY.

(*Ecole Normale de Tir.*)

Foundation in 1842.

The School of Musketry, formed by the Ministerial Order of 29th March 1842, was only intended at first to supply instructors to the ten battalions of Chasseurs who were armed with rifles. The results of its establishment were, however, found so valuable, that the benefits of the instruction it afforded were by degrees extended to the whole army.

Changes in 1845,

In 1845, the Duc d'Aumale, who had taken a special interest in the improvement of fire-arms and the better instruction of the soldier in their use, was nominated Inspector-General of Schools of Musketry. Besides the chief school at Vincennes, others were formed in the principal garrisons; and eventually a regimental School of Musketry was established in every regiment of infantry.

and 1852.

Some changes have been made in the system established under the Duke. The School of Musketry at Vincennes has only been regularly organized on its present footing since 1852. A portion of the fortress affords the accommodation required for the theoretical instruction, while the Polygon offers admirable facilities for practical instruction and target practice.

Staff.

The Staff of the School consists of,—

A Commandant, a Lieut.-Colonel of Infantry.
An Instructor in Musketry, a Major of Infantry,
(at present M. Minié, whose name has become so famous in connection with rifles).
A Professor, a Captain of Artillery.
An Assistant Professor, a Captain of Artillery.
A Sub-Instructor in Musketry, a Captain of Infantry.

Course of instruction.

Each regiment sends an Officer (a Sub-Lieutenant or a Lieutenant) to Vincennes, to go through the course of instruction. The course commences on the 1st of March, and lasts four months. Two hours a day three times a week are devoted to lectures on the construction and use of fire-arms, and the theory of projectiles. Each Officer is required to complete a certain number of drawings of the separate parts of arms. At the termination of the course, certificates are given, and, if favourable, go towards the Officer's claim to be promoted "*au choix*." The number of Officers for the present year would be about 130. At the period of our visit (the 27th of February), the Officers had not all arrived.

Visit to the School.

We were conducted over the rooms of the fortress set apart for the School by the Officer charged with the Theoretical Instruction (Captain Févre, of the Artillery). They consist of a large paved room, where the Officers perform their small-arm exercise in bad weather; of the study-room, in which the drawings are executed; of a lecture-room or amphitheatre; of the library, chiefly supplied with technical works on arms; and of a model-room, containing a very good collection of French and foreign arms, and of portions of arms, to illustrate the lectures. There are, besides, private rooms for the instructors, and a room for the orderlies. On the ground floor a small forge has been fitted up for the purpose of giving practical instruction in some of the details of the manufacture of arms.

To produce accurate marksmen is not the only object of the School of Musketry. Its staff may be considered a description of standing committee, to whom inventions in arms and ammunition are submitted, to have their qualities practically tested. On the day of our visit experiments on the relative merits of three forms of balls were being carried on, which the Commandant invited us to witness.

Practice.

Quitting the fortress by a bridge over the ditch, in an angle of which the Duc d'Enghien was shot, we entered on the Polygon or practice ground. In a few minutes two detachments of troops, one from the Chasseurs de Vincennes, the other from the 20th regiment of the line, arrived and took up their ground in front of the practice butts. Of the balls between which comparisons were to be made, one was proposed by M. Minié, who was himself present, another by M. Nessler, the third was named the ball "*de la garde*." There were six targets in line in

front of the butt; the Chasseurs fired at three of them, and the 20th regiment at the other three. A trench runs along parallel to the butts, and at a few yards in front of them. The line of targets is in the space between the trench and the butts. The trench gives cover to the range party, one of whom is stationed opposite to each target, in a rude recess cut into the side of the trench, to afford shelter in wet weather. Each time a target is struck, the man opposite to it raises his banderol, which is then seen by the firing party, and acknowledged by their trumpeter.

The trench is continued to some distance beyond the butts, and is there met by another trench at right angles to it; so that one may go up from the firing party to the range party without any risk.

On the cessation of the firing, the Officer in command of the range party numbered the hits in each target. He marked separately the hits where the balls had arrived sideways (shown by the form of the perforation), a very important consideration in comparative experiments with oblong balls.

Prizes and honourable mentions are bestowed annually on the best shots. The number of the regiment and the names of the men thus distinguished are inserted in the official military journal.

GENERAL REMARKS ON FRENCH MILITARY EDUCATION.

The following Summary may close our account of French Military Education.

Combination of highly educated Officers with others.

1. The French army combines a considerable proportion of Officers professionally educated, with others, who form the majority, whose claims to promotion consist in their service, proved ability, and conduct. One-third of the Officers in the line, two-thirds of those in the Scientific Corps, and the whole of the Staff receive a careful professional education; the remainder are taken upon the recommendation of their superior Officers, from the ranks. But it was stated to us expressly that such Officers do not often rise above the rank of Captain.

No junior Military Schools.

2. There are no junior military schools in France, and no military education commences earlier than sixteen. This is the very earliest age at which pupils can be received at the Polytechnic or at St. Cyr, and the *usual* age is later; whilst in the case of the Special Corps, strictly professional education does not begin till twenty or twenty-one. The best preparation for the military schools is found to be that *general* (in France chiefly *mathematical*) education which is supplied by the ordinary schools of the country, directed as these are and stimulated by the open examinations for admission to St. Cyr and the Polytechnic.

Education at St. Cyr,

3. The professional education for commissions in the line is that given at the school of St. Cyr. A fair amount of mathematics is required at entrance, but the chief instruction given at the school is of a professional character. Active competition, however, which is the principle of all French military education, is kept up amongst young men educating for the line by the competitive entrance to the school, by the system of examinations pursued in it, and in particular, by the twenty-five or thirty places in the Staff School which are practically reserved for the best pupils on leaving.

School,

4. In the Staff School itself the competitive system is acted upon; there are strict examinations, and the pupils are ranged in the order of merit on leaving the College.

at the Polytechnic.

5. The Officers of Artillery and Engineers may be said to be in quite a peculiar position in France, owing to the high education given at the Polytechnic School. The consequence is, that the preparatory education of French Artillery and Engineer Officers is of the highest scientific character. We have already spoken largely on this point, and need do no more than allude to it.

Mathematical character of the studies.

6. We may remark, that preparatory military education in France is mainly mathematical—at the Polytechnic almost wholly so. The literary and classical elements, which enter so largely into all education in England and Prussia, are in French military education very much thrown aside. Lectures in military history and literature are said, however, to succeed at St. Cyr.

State assistance by *Bourses*.

7. The system of State foundations (*Bourses*) existing in the Polytechnic and St. Cyr, and affording a curious parallel to the military foundations in the Austrian schools, requires some notice. Every pupil, in both the Polytechnic and St. Cyr, who can prove poverty, is entitled to State support, either entire or partial. At the present time, not less than one third of the students in each of these schools receive such maintenance. The system of civil *Bourses* is of old standing in France; most of these were destroyed at the Revolution. They were renewed and greatly devoted to military purposes by Napoleon. The extent to which they are given may seem excessive, but it must prove a powerful incentive and assistance to talent.

Training of Officers in the Special Corps after joining.

8. It has been remarked that there is comparatively little practical teaching in the School of Application for Artillery and Engineers at Metz. But a very extensive practical training is in fact supplied to these Officers after they enter the service, remaining as they must do with the troops until promoted to the rank of Second Captain, and subsequently being employed in the arsenals, workshops, fortified places, &c.

No Senior Departments.

9. The French have no "senior departments" for military education. In this respect their practice differs from that of England and Germany.

10. The military schools in France are under the immediate control of the Minister of War. There cannot be said to exist a separate Military Education Department, as in Prussia and in Austria. On the other hand, however, there is a force of independent position and influence possessed by the Polytechnic and its great Schools of Application, all controlled by its Board of Improvement or its Senate, which does not attach to any school of a military character in other countries. This is again one of the many points in which it may be called an institution of its country, and in which it resembles (as in other respects alluded to) an English university.

Want of an Educational Department partly supplied by the Council of Improvement at the Polytechnic.

11. We have elsewhere drawn attention to the large sum, upwards of 70,000*l.*, annually devoted in France to military education. This is almost entirely spent on the education of officers. The expenses of the Regimental Schools are not included in the sum.

Expenditure.

AUTHORITIES.

List of works consulted.

I. The principal work consulted on the General Military Organization of France is Vauchelle's Cours d'Administration Militaire, vol. i—iii.

Polytechnic.

II. The works connected with the Polytechnic School are very numerous. The following are the principal:—

1. Fourcy's Histoire de l'Ecole Polytechnique, 1 vol.
2. Décret portant l'Organisation de l'Ecole Polytechnique. (Translated in Appendix A.)
3. Règlement pour le Service Interieur. (Appendix B.)
4. Programme de l'Enseignement Interieur.
5. Programme des Connaissances exigées pour Admission à l'Ecole en 1855, approuvés par le Ministre de la Guerre. (This and the above contain a full account of the studies required for admission and those of the School.)
6. Rapport de la Commission Mixte. 1850.
7. Répertoire de l'Ecole Polytechnique, by M. Marielle, many years treasurer of the school. This useful work contains a complete list of the pupils of the Polytechnic since its first opening, an account of their subsequent careers, and elaborate statistics of various kinds.
8. Calendars of the School, also published by M. Marielle, from 1833 to 1846.
9. Numerous pamphlets have also appeared on disputed subjects, with regard to the teaching, &c. Such are, in particular, l'Ecole Polytechnique, par M. le Marquis de Chambray, 1836. L'Ecole Polytechnique, par V. D. Bugnot, Capitaine du Génie, Inspecteur des Etudes, 1837. L'Organisation de l'Ecole Polytechnique, par un Officier Superieur d'Artillerie, 1842. Sur l'Ancienne Ecole Polytechnique, par M. Arago, Directeur de l'Observatoire, 1853.

There are no legitimate text books in the School; but a series of manuals by eminent men of science, published by M. l'Anglois le Clerc, seem to be in use.

We procured one specimen of the lithographed sheets used by the students in the lecture rooms, viz., that on Military Art and Fortification.

School of Application at Metz.

III. With regard to the Ecole d'Application at Metz, we were furnished by the authorities with the Décret Impérial portant l'Organisation de l'Ecole Imperiale d'Application de l'Artillerie et du Génie, 1854; translated in Appendix H.

We also received the Regulations and Programmes, of most of which an abridged translation will be found in Appendix I.

St. Cyr.

IV. We received similar Regulations and Programmes at St. Cyr, of which we have made great use in our account of that School.

School of Application for the Staff.

V. Full information is given on the School of Application for the Staff in a small volume (noticed in our account), the Manuel Réglementaire à l'Usage des Officiers Elèves de l'Ecole d'Application du Corps Imperial d'Etat Major.

Lycées.

VI. On the Lycées and the new system of the bifurcation, the chief authority is Nouvelles Lois sur l'Enseignement, suivies des Décrets, Règlements, et Arrêtés, avec un Commentaire par Th. H. Barrau, Paris, 1854. Details of the Instruction are given in the Plan d'Etudes, Paris, 1853.

In the Appendix will be found the following articles further illustrating the subject of the French Military Schools :—

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PRUSSIA.

PRUSSIA.

The mode in which the Prussian Army is raised and organized, it is well known, is peculiar, and the general military system differs widely from that adopted in other countries, and from that which up to the battle of Jena was followed in Prussia itself. The great change was gradually effected during the years immediately preceding the French war of 1813, and the law which is referred to as the basis of the new organization is that of the 3rd September 1814. In accordance with this law, every Prussian above twenty years of age is bound (*verpflichtet*) to service in arms for the defence of his country. The Army or military force of Prussia.

The military force of the country is made up of three distinct bodies, and the whole of the adult male population is distributed among them. It consists of,— Its divisions.

I. The Standing Army.
II. The National Militia or *Landwehr*, divided into two portions, viz., the First *Landwehr* and the Second *Landwehr*.
III. The Last Reserve or *Landsturm*.

I. The Standing Army is composed of all young men between twenty and twenty-five years of age. The period of service in time of war is for five years, but in time of peace the young soldiers can obtain leave of absence after three years' service;—they belong for the remaining two years to what is termed the "reserve," receiving neither pay nor clothing, and they are subject to be recalled if war should break out. The Standing Army; period of service.

Encouragement, indeed, is given and advantages held out to induce men to stay, and to take a new engagement for an additional term of six years; but it is said that only a small number are thus obtained. The bulk of the troops are men serving for this short time; and there are many, it should be added, whose term of service is even yet shorter. For all educated young men, all, that is, who pass a certain examination, are allowed, on condition that they pay for their own equipment and receive no pay, to shorten their service from three years to one. This privilege appears to be very largely used. It should also be stated, that young men of any class may volunteer to perform their service at any age after seventeen.

The Prussian Standing Army amounts at the present time to about 126,000 men. It is divided into nine Army-Corps or Corps d'Armée, one of which is named the Guard, and the others are numbered from I. to VIII. In each there is a regiment of Artillery and a division of Engineers. A regiment of Artillery consists, in time of peace, of three divisions; each division of one troop of Horse Artillery and four companies, of which, one is Fortress Artillery with two-horsed pieces. Each regiment has thus three companies for the service of the fortress and twelve for field service. The whole of the Artillery is under the command of a General Inspector, and it is divided into four Inspections. An Engineer Division is composed of two companies. There are nine Engineer Divisions, one in each Army-Corps. The whole are commanded by a General Inspector, and they are divided into three Inspections. Its divisions.

The promotion in the Prussian Infantry and Cavalry is regimental, and by seniority, up to the rank of Major; after that it is by selection; and an Officer who has been passed over two or three times may consider that he has received an intimation to retire from the service. In the Artillery the promotion is by Regiments; in the Engineers it is general.

II. The First Landwehr, or Landwehr of the *first* summons (*des ersten aufgebots*), consists principally of young men between twenty-five and thirty-two years of age, who enter when they have completed their period of service in the Standing Army. They are called out once every year for service with the divisions of the Standing Army to which they are attached, for a period varying from a fortnight to a month; and they may be sent in time of war on foreign service. The Landwehr.

Those who have passed through the First Landwehr, enter at the age of thirty-two in the Second Landwehr, or Landwehr of the *second* summons (*des zweiten aufgebots*). They are called out only for a very brief service once a year, and

they cannot at any time be ordered out of the country, but continue to form a part of the *Second* Landwehr until they are thirty-nine years of age.

The Landsturm.

III. After the age of thirty-nine a Prussian subject belongs to the last Reserve or Landsturm, and can only be summoned to service in arms upon a general raising, so to say, of the whole population, when the country is actually invaded by the enemy.

With the Standing Army, the centre of the system, all the other forces are kept in close connexion. For every regiment of the Standing Army there is a corresponding regiment of Landwehr, and the two together form one brigade. In the local distribution, every village and hamlet of the Prussian dominions belongs to a certain regiment of Landwehr, serving with a certain regiment of the Army, and belonging accordingly to one of the nine Army Corps.

Historical account of the origin of the present form of the Prussian military force.

Such is the military organization, which, from the important part played in it by the *Landwehr*, is sometimes termed the Prussian *Landwehr* system. The history of its formation is remarkable, and the circumstances which led to its creation helped also to create the very peculiar education of the army.

Landwehr and Landsturm are old German names.

The Prussian *Landwehr* or Militia is not of modern origin; in its form at least it is but a revival of the old feudal military organization, so far as that consisted of raising the country *en masse*, instead of keeping up a permanent, trained, and limited military force. *Landwehr* or *Landsturm** was the old German name for this feudal array, before the system of standing armies was begun in Europe by Charles VII. of France, with his Scotch regiments. It was possibly the failure of the trained Prussian armies—long reputed the models of military discipline—in the attack upon France in 1792, and still more signally at Auerstadt and Jena, which partly led to the revival of the *Landwehr* as the peculiar national force of Prussia. The means by which Stein, and after his expulsion, Scharnhorst, called it into activity, was a master stroke of policy under the existing difficulties of the country. The following outline may be sufficient to explain its effects upon education.

The creation of the modern Landwehr occasioned by the conditions of the Peace of Tilsit.

The condition which Napoleon had exacted at Tilsit—a reduction of the standing army from 200,000 to 40,000 men—would have lowered Prussia at once to the rank of a second-rate Power. It was adroitly evaded by the plan of keeping only 40,000 men in arms at one and the same time, disbanding these as soon as they were disciplined, and replacing them constantly by fresh bodies. Thus the whole population of the country was ready to rise in 1813, after the crisis of Napoleon's retreat from Russia. The plan was chiefly due to the genius of Scharnhorst, whose early death deprived Prussia of her greatest scientific soldier. The *Landwehr* then proved itself a most efficient force, though its success was promoted by the national enthusiasm, which must prevent our taking such a period as a criterion of its permanent military working. Since that time it has continued to be the national army of the country.

Influence of this change in the education of the army.

We were assured that this peculiarity of the Prussian Army system, by which almost every man in the country serves in his turn in the ranks, has had a tendency to improve the education of the Officers. It seems to have been felt that the Officers would not retain the respect of intelligent privates unless they kept ahead of them in education. And this impression appears to have been the cause of the royal edicts passed in 1816, by which it was required that every Prussian Officer should pass two examinations before receiving his Commission, one to test his general education, and the other his professional knowledge. Some valuable evidence sent to us by Colonel von Holleben, the Adjutant to the General Inspector of Military Education, to which we shall often refer, calls our attention to this point. After referring to the *general* examination, he mentions it as a main object of the *professional* one, "that the "younger Officers, even if they have never received the full training of the "gymnasium, may still, by their professional training, raise themselves above "their subordinates; a class in Prussia often highly educated."

Vide p. 132, *s.* 5.

Mode in which the Standing Army is officered.

The Standing Army, composed in the manner and under the circumstances we have described, is supplied with Officers in a somewhat peculiar manner.

No young man can enter the Army directly as an Officer except about thirty, annually taken from the highest class of the *Selecta* of the Cadet

* Thus *Landsturm* is the word used for the rising *en masse* of the Tyrol in 1809.

House. All others must serve for a certain portion of time in the ranks, and in every case they must prove by two examinations that they are possessed, first, of a good general education, and secondly, of a considerable amount of professional instruction, before they can obtain the rank of an Officer. The usual course is as follows:—

i. Nomination by the Colonels.

Young men obtain a nomination from the Colonel of a Regiment. This nomination admits them merely to service in the regiment as privates, with a recognition of their being candidates, *aspiranten* or aspirants, for the rank of Officer. Before they obtain that rank, the following conditions must be fulfilled. They must pass an examination in the common subjects of a good general education, such as the sons of well-born or wealthy civilians may be supposed to receive. They must serve six or nine months with the troops; they must attend nine months at a Division School, or twelve months in the Artillery and Engineer School, where they receive a course of special military instruction; and they must pass an examination in professional subjects before a Board sitting at Berlin. They are then eligible for a vacancy. In order to obtain a commission they require further the recommendation of the Officers of the Regiment.

It is obvious to remark, that in obtaining a commission in the Prussian service the candidate's chance depends greatly on the recommendation of the Colonel and the after assent of the Officers. The effect of this is to maintain an exclusive character in the Army. Above two-thirds of the commissions are obtained by the course described above; the remainder are granted to those who pass through the Cadet Schools.

ii. Instruction at the Cadet Schools.

Of these there are five altogether, four junior establishments, situated in certain provincial towns, and one Senior or Upper School at Berlin, to which the others are merely preparatory. They are all supported by the State; mainly for the purpose of educating the children of meritorious Officers in want of assistance; but they are also open to others. With the exception of the highest class of the upper school, the *Selecta*, above mentioned, the instruction given is of a perfectly general character, and there is no obligation even for those who have received the most ample pecuniary assistance to enter the military profession. The discipline, however, is military, the teachers are mostly Officers, the pupils are regularly drilled, and most of them actually go into the Army. This they do in ordinary cases without going through the highest or select class in which professional instruction is given; they merely pass the same preliminary examination as the candidates nominated by the Colonels of Regiments; they enter the Army without their commissions, and have to obtain them in the same manner as the other candidates, by serving six or nine months with the troops, and by following their professional studies in the Division or Artillery and Engineer Schools, and by passing the Officers' or second Examination before the Examining Board at Berlin. Those who do remain to go through the highest or select class receive their professional instruction in it instead of in the Division or Artillery and Engineer Schools, and they are examined for their commissions by the Board while still at the Cadet School.

The three requisites.

Thus, in the course usually followed, three requisites are exacted in Prussia before a commission is given; first, a good general education; secondly, some actual military service; and, thirdly, professional knowledge gained by something like a year of military study. But the military service is not required from the upper thirty students of the *Selecta* of the Cadet House.

The two Examinations.

It will be well to mention, at the commencement, the names of the two examinations. The first, the Preliminary Examination, merely testing the general education, admits to a particular grade among Non-commissioned Officers; those holding it rank between Sergeants and Corporals, and in consideration of their being candidates (*aspiranten*) for a commission wear a different sword-knot, and hence have the name of Sword-knot Ensign or *Portepée-fähnrich*. The first or preliminary examination is accordingly called the *Portepée-fähnrich* Examination. The second, the professional one, is the Officers' Examination, for the commission of Second Lieutenant.

The Boards of Examiners: the Central or Supreme Military

These two examinations, for the grade of *Portepée-fähnrich* and for the Officer's commission, are either conducted or controlled by the Supreme Military Examinations Board (*Ober-Militair-Examinations-Commission*) in

Examination Board.

Berlin, a body partly composed, as will be seen by the list in the note,* of Military Officers, partly of eminent civilians.

The various Examining Boards, the Central and the Local ones, which conduct these two Examinations, are quite independent of the Military Schools, and were formerly presided over by a different head; but in order that the system should be uniformly carried out, and as Colonel von Holleben expresses it, that "*the examinations should exercise a salutary influence on education, and that their standard should be adjusted to the capacities of the schools*," they have now been placed under the same control as the Military Schools.

Vide p. 129.

The General Inspector of the whole system of schools and examinations.

The whole department of Military Education is therefore now under the control of a single high functionary, bearing the title of the General Inspector of the Military Schools, Military Education, and Military Studies (*das Militair Erziehungs-und-Bildungswesen*), Lieut.-General Von Peucker, who reports direct to the King on all subjects relating to examination and instruction. He submits his proposals on matters of administration to the Minister of War, who issues the necessary orders to the Boards charged with the financial control of the various Schools.

The Supreme Board of Studies acting as his Council.

The General Inspector is assisted by a Supreme Council or Board of Military Studies, composed of Field Officers of the General Staff and of the Special Arms, the Directors of the War School, of the Supreme Board of Military Examinations, of the Artillery and Engineers School, the Commander of the Cadet Corps, some of the Consultative Assessors (*Vortragenden Räthen*) of the Minister of Worship, and of individuals selected from the general body of learned men (Professors).

The Military Schools.

The principal Military Schools of Prussia may be divided into five classes:—

I. Those which give a good general education to the sons of meritorious Officers, but which are open to others, such as—

1. The Cadet Houses or Cadet Schools (*Cadetten-Haüser*), which supply a certain amount of instruction in military professional subjects.

II. Such as supply professional instruction to young men who are candidates for the rank of Officer in the Prussian Army. These are—

2. The Division Schools (*Divisions-Schule*), nine in number, one for each Army Corps.
3. The Artillery and Engineers School in Berlin.

III. Those which afford professional instruction to Officers already in the service, to qualify them for special duty, limited to—

4. The War School or Staff School (*Kriegs-Schule*) in Berlin.

IV. Those intended to give special instruction for the training of Non-commissioned Officers and men. Such as—

5. The School Division or Non-commissioned Officers School (*Schul-abtheilung*) at Potsdam.
6. The Regimental Schools (*Regiments und Bataillons Schulen*).
7. The Music and the Swimming Schools, and the Central Gymnastic School in Berlin (*Central Turn-Anstalt*).
8. The Veterinary School (*Thierarzeneischule*).

V. Those intended to give gratuitous education to the children, boys and girls, of Non-commissioned Officers and Soldiers, whose parents are too poor to provide for them. Such are,—

9. The Military Orphan Houses (*Militair-Waisenhaüser*) at Annaburg, Potsdam, and Pretzsch.
11. The schools for soldiers' children.

In addition to these might be mentioned the Medical Institution, particularly the Frederick-William's Institution at Berlin, and the Knight Academy (*Ritter-Academie*), or Noble School, in Liegnitz.

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* Minister of War, Major-General Count Waldersee.

Department of the General Inspection of Military Instruction, and of the state of Education in the Army (*das Militair-Erziehungs-und-Bildungswesen der Armee; General Inspection*):—General Inspector, Lieut.-General von Peucker; Adjutant, Lieut.-Colonel von Holleben.

Supreme Military Examinations Board (*Ober-Militair-Examinations Commission*):—Director, General Schmidt; Secretary, Major Wittcke. Examiners:—Major von Berneck; Major Baron Haller von Hallerstein; Captain Viehler, (Engineers); First Lieutenant Schinkel (Artillery) First Lieutenant Eltester (Engineers); Professor Mützell of the Joachimsthal Public School Professor Herrig of the Cadet Corps; Professor Foss of the Frederic-William Public School.

The annual cost to the State of the Military Schools, as extracted from the last yearly statement, appears to be as follows :— Expense to the State of the Military Schools.

Name.	Salaries. Dollars.*	Other Expenses. Dollars.*	Total Dollars.*	Number of Students.
Department of General Inspector - -	5,872	250	5,922	—
Supreme Military Examinations Board - -	5,400	300	5,700	—
Board of Military Studies - - -	848	..	848	—
Board of Examiners for Artillery Lieutenants -	..	60	60	—
Cadet House at Berlin - - - -	12,944	..	12,944	420
„ „ Potsdam - - -	15,805	24,285	40,090	200
„ „ Culm - - - -	15,738	18,436	34,174	160
„ „ Wahlstatt - - -	16,253	22,706	38,959	209
„ „ Bensberg - - -	15,935	24,853	40,788	200
General War or Staff School - - -	18,552	3,013	21,565	120
United Artillery and Engineers School - -	15,025	1,910	16,935	240
Veterinary School - - - -	8,514	4,165	12,679	—
Gymnastic School - - - -	4,046	720	4,766	—
Division Schools - - - -	10,800	6,195	16,995	Variable.
„ Libraries - - - -	400	1,200	1,600	—
Miscellaneous - - - - -	..	680	680	—
Totals - -	146,132	108,777	254,909	

Amounting to about £38,236 annually, exclusive of the charge for buildings and repairs, and the original outlay for their first establishment. The pay of the student Officers, and the pay and allowances of the Military professors and teachers, are, however, drawn from their corps, so that the above-mentioned seems only to include the extra pay granted to the professors, &c.

The expenses of the Non-commissioned Officers School, of the Military orphan houses, and of the schools for soldiers children, are not given in the printed paper from which these details have been extracted.

Of these Schools we visited and propose to describe, two of the Cadet Houses, one at Berlin, the other at Potsdam, a Division School at Potsdam, the Artillery and Engineers School, and the War School at Berlin, a Military Orphan House, and the School Division or Non-commissioned Officers' School at Potsdam. Schools visited.

In accordance with the preceding arrangement, we shall adopt the following plan in describing the Prussian Military Schools :—

Section I. will contain an account of the two examinations which every candidate must pass in order to qualify himself for a commission.

Section II. will be devoted to a description of the three kinds of schools in which candidates are prepared to pass these examinations :—

1. The Cadet Houses which give the earliest education, inclining, though not necessarily leading, their pupils into the Army.
2. The Division Schools which prepare aspirants in the Line for the principal of those examinations.
3. The Artillery and Engineer School, which prepares the candidates belonging to those services for the same examination, and subsequently affords them scientific professional instruction to qualify them to pass as Officers of Artillery or Engineers.

Section III. will contain by itself the Staff School, or as it is called both in Prussia and Austria, the War School, the senior department for Officers who have served some years.

Section IV. will contain the Military Orphan Houses and the School Division or Non-commissioned Officers' School.

Section V. will contain an outline of Prussian Military Education from the time of Frederic the Great, and two papers which have been drawn up for us by Colonel von Holleben, the first being a "General View of the System of Military Education in Prussia," and the other, an "Historical View of the Origin and Changes of the Division Schools."

Section VI. will contain translations of official Documents connected with the Artillery and Engineers School.

* A Prussian dollar is equal to three shillings of English money.

SECTION I.—THE TWO EXAMINATIONS, GENERAL AND PROFESSIONAL, FOR A COMMISSION.

The Preliminary and the Officer's Examination.

We have already stated that two examinations, one in *general*, the other in *professional knowledge*, are required of nearly all candidates for a commission *upon* or *soon after* their entrance into the Army. One exception only is made to this rule. Young men with a certificate of having successfully completed the full course of a first-class Public School or Gymnasium are excused from the *general* examination. The pupils belonging to the *Selecta* of the Cadet Schools having gone through a course of strictly professional military study, pass both these examinations *before* they enter the Army.

These two examinations, through which alone admission is obtained to the rank of officer, are so important, and hold so prominent a position in the Prussian military system, that we propose to preface our account of the nature and extent of each of these examinations by a short tabular statement of the circumstances under which the candidates for each arm of the service respectively pass them.

The following Candidates offer themselves,	for the Preliminary, Ensign's, or *Portepée-fähnrich* Examination,	for the Second or Officer's Examination (in all Cases before the Supreme Board at Berlin).
Those presented by the Colonels of Regiments,	Before, after, or during (usually before) six months' service with the Troops, before the local Divisional Board;	After nine months' military instruction in the Division School.
Those coming at the usual time from the Cadet House (from the class called *Prima*),	On quitting the Cadet House, before the Supreme Board at Berlin;	After six months' service with the Troops, and nine months' military instruction in the Division School.
Those who stay an extra year in the Special or Select class (*Selecta*) of the Cadet House,	Before admission to the Special or Select class (*Selecta*), before the Supreme Board at Berlin;	On quitting the Cadet House, after one year's military instruction in the Select class (*Selecta*).
Those for the Artillery or Engineers, except when they come from the Special or Select Class, *Selecta*, of the Cadet House,	After nine months' service with the Troops, and three months' stay at the Artillery and Engineers School, before the Supreme Board at Berlin;	After one year's stay at the Artillery and Engineers school.

I. *The Preliminary or Ensign's* (Portepée-fähnrich) *Examination.*

The Law for Admission as Candidates.

According to a special law, any young man above seventeen and a half and under twenty-three years of age, whether he be a private or a corporal, if he has served six months in the Army, and can obtain from the Officers of his Company a certificate of good conduct, attention, and knowledge of his profession, may claim to be examined for the grade of Ensign or *Portepée-fähnrich*. If he succeed in this examination, he is recognized as a candidate, an *aspirant* for a commission; but his prospect of obtaining a commission is subject to a variety of subsequent conditions.

The actual Practice.

In practice, a young man who aspires to a commission applies to the Colonel of the Regiment and usually obtains a nomination before he actually joins; and, as the examination is entirely of a civil character, he is usually glad to try and pass it at once. Having recently come from school, he feels probably better prepared than he is likely to be at any subsequent time: for on joining the corps, he will have for some time to conform to the life of a private soldier, to sleep and mess with the men, and to mount guard in his turn; and with the drill and exercises, and the marching and manœuvring with the troops, he will have enough to occupy him to prevent his preparing for the examination. The two qualifications for the Ensign's grade are, the test of the examination and the six months' service; but it appears to be indifferent in what order they are taken, whether service comes first and examination after, or *vice versâ*.

The examinations take place quarterly, at the beginning of every January, April, July, and October. They are held in the great garrison towns by Local Military Boards, consisting of a President and five Examiners. Applications for permission to be examined must be made at least a fortnight before, and must be accompanied by certificates stating the candidate's birth, parentage, &c.; certificates of diligence and good conduct from the schoolmasters or other teachers who have instructed him; and of bodily fitness from an Army Surgeon. The quarterly Examinations in the Garrison Towns. Certificates.

The Local Board of Examiners is appointed by the General Officer in command of the Army Corps, the centres of examination corresponding in present practice with the localities assigned to the Division or Army-Corps schools, nine in number, presently to be described.

The first part of the examination is on paper; a *vivâ voce* examination follows. Paper Work.

On paper the young men have to write three themes or compositions in German, to translate two passages, one from Livy or Sallust, another from Cæsar's Commentaries, Cicero's Epistles, or Quintus Curtius; to translate sixteen or twenty lines from French into German, and two passages, a longer and a shorter, from German into French. They have one question in common Arithmetic, one in Equations, Progressions, or Logarithms; one in Geometry, one in Trigonometry; they have one in Mathematical or Physical Geography, one in the general Geography of Europe and its Colonies, and one in that of Germany and Prussia. There is one question in Greek or Roman history; one in the earlier German history; one in modern; and one in Prussian history. They have also to show that they are acquainted with the common conventional signs used in representing the surface of the earth in maps; and they have to copy a small map of a group of hills.

The time allowed for each question is about three quarters of an hour or an hour; for each German theme, it is as much as an hour and a half or two hours.

The questions are of a comprehensive character; *e.g.* Give a history of the campaign of 1813, or of the life of Alexander the Great; Enumerate the rivers flowing into the Mediterranean Sea, with the principal towns situated upon each of them. The German themes are, first, a *curriculum vitæ*, an account of the candidate's life, which is, however, not supposed to count in the result, and is merely for the Examiner's information; second and third, two themes on some sentence or proverb, for the first of which the Examiner assists the candidate by *vivâ voce* questions and corrections in drawing up the preliminary outline of arrangement; for the second he is left entirely to himself.

There is a subsequent *vivâ voce* examination in all the subjects, drawing excepted. The candidates are taken in small classes, not exceeding seven in number, and are examined together, but not in public. The *vivâ voce* Examination.

The results of the examination are considered according to the system of *predicates* or epithets, sometimes also called *censures*. The candidates' answers are characterised as excellent (*vorzüglich*), good (*gut*), satisfactory (*befriedigend*), insufficient (*nicht hinreichend*), or unsatisfactory (*ungenügend*). Numerical values are attached to each of these epithets; "excellent" is marked with 9; "unsatisfactory" counts as 1; and according to the amount of importance attached to the different subjects the marks thus given are multiplied by a higher or lower number, by 5 in one case, by 3 or by 1 in others. German, Latin, and Mathematics have all the highest estimate of 5, and are each five times more important than Drawing, which is marked by 1; Geography, History, and French are each valued at 3. A young man who gets the *predicate* "excellent," in German, will receive 45 marks, his 9 being multiplied by 5; whereas the same predicate for History would obtain him only 15, and in Drawing only 5 marks. Result.

German	5	Total, 25.
Latin	5	
Mathematics	5	
History	3	
Geography	3	
French	3	
Drawing	1	

A Report is then drawn up, and according to the marks or predicates, the candidates are pronounced as admissible with distinction, admissible with honour, or simply admissible; or their re-examination after six months, their re-examination after a year, or their absolute rejection, is recommended.

Report made to the Board in Berlin.

This Report, with the candidates' certificates, is forwarded to the Supreme Military Examinations Board at Berlin, and, if approved by them, is submitted in their quarterly Report to the King; and the result, when sanctioned by him, is communicated to the respective Corps.

The candidates are all informed not only of the practical result, but also of the particulars of their examinations; they are told in what subjects they have failed, and in what they have succeeded. The candidates cannot, under any circumstances, try more than three times.

The Promotion.

The young men who pass, are thus, so far as their qualification in point of knowledge is concerned, pronounced admissible to the Ensign's grade. They have of course to complete their six months' service with the Troops. Yet even when this is completed, a vacancy in the list of Ensigns must be waited for, and months may pass before the aspirant receives the distinctive badge, the special sword knot, which marks his superiority to the Corporals, and shows that he has gained the first step that leads to a Commission.

Means by which preparation is made for this Examination.

The examination that has now been described is obviously one for which preparation may be made in the common public schools, and under the usual civilian teachers. A young man of seventeen need not have been positively destined to the military profession, nor have gone through special preparation for any length of time beforehand. The Boards of Local Military Examiners are content to take them as they are offered, inquiry only being made as to their birth and connexions, and their previous behaviour at school or under tuition.

The Gymnasiums.

In fact, those who have passed successfully through the full course of a school which prepares for the Universities (a gymnasium) are excused the Ensign's examination. The certificate they have received on going away from school, upon the *Abiturient's* or Leaving Examination, as it is called, is considered quite sufficient; except in the case of candidates for the Artillery or Engineers, who are expected to show greater proficiency in Mathematics; and certainly a boy in the head class of a gymnasium ought to be able to pass the Preliminary Examination with perfect ease and with credit. The amount of knowledge required and the particular subjects selected are not those of the first, and are scarcely those of the second class of a gymnasium; and the assertion was even made that a boy from the upper third class might very well hope to pass for an Ensigncy. Possibly a little extra tuition from the preparatory establishments, which are said to have sprung up with the special function of "fabricating Fähnrichs" might in this instance be required.

Programme of Studies required for Ensign's Examination.

The official programme is here given, and may be compared with the studies prescribed in the upper classes of the Cadet House at Berlin (*see* the account of that school).

1. In their own language, good legible handwriting, a correct style, free from orthographical or grammatical mistakes, facility of expression in writing and speaking; some evidence of a knowledge of German literature.

2. In Latin, facility in understanding the Latin prose writers ordinarily read in the second class of a Prussian gymnasium. A written exercise in translation from Latin into German; grammatical analysis of some passages.

3. In French, facility in reading and in translating from German into French, and French into German, grammatical analysis of French sentences, and a knowledge of syntax.

4. Mathematics:—

(*a.*) Arithmetic and Algebra;—familiarity with the ordinary rules for the extraction of the square root of whole numbers and of fractions; Proportion and its applications including questions in Partnership and Compound Proportion; the theory of powers and roots, with integral and fractional, positive and negative exponents. Equations of the two first degrees, with one or more unknown quantities; Logarithms, Logarithmic Equations, Arithmetical and Geometrical Progression, and practice in the application of the various theories.

(*b.*) The complete elements of Plane Geometry, mensuration of rectilineal figures and of the circle, transformation and division of figures; the first elements of the application of Algebra to Geometry.

(*c.*) Plane Trigonometry, Trigonometrical functions and their Logarithms. Use of trigonometrical tables. Calculation of particular cases of triangles, regular polygons, and segments of circles.

In consideration of the especial importance of this discipline for Officers of the Artillery and Engineers, a higher predicate (*i.e.* a greater number of marks) will be required in the exercises of candidates for these two services; the knowledge expected in their case will be, though not more extensive, more thorough and deep.

5. Geography :—The general principles of Mathematical and Physical Geography, knowledge of our planetary system, of the motions of the Earth, and of the phenomena immediately dependent upon them. Readiness in drawing from memory the outlines of the more important countries, with their principal mountains, rivers, and cities. General outlines of Political Geography, in the case of the mere States out of Europe; a detailed account of the elements of European statistics, more particularly in the case of Germany and Prussia.

6. History :—A knowledge of the more remarkable events in the history of great nations, of the general connexion, causes, and consequences of these events; a knowledge of the remarkable men of all such nations down to the present time. Special knowledge of the history of Greece, Rome, Germany, Prussia, with particular reference in this last case to its external growth, inner development, and to the principal events of the most important wars since the middle of the 18th century.

7. Readiness in general drawing, and in constructing mathematical figures; some skill in drawing plans of positions and mountains, in the way of preparation for military plan drawing.

8. The candidate may, in addition, be examined in other subjects, in which his certificates show that he has been instructed; for example, in Natural Philosophy, so far as included in his previous course of instruction.

It must be remembered that either before or after this examination some months must be spent in actual service with the troops by all but the pupils belonging to the *Selecta* of the Cadet School; and that nine months of study at the Division and Artillery and Engineer Schools intervenes before the Officers examination takes place.

2. *The Second or Officer's Examination.*

It is held at Berlin before the Central Board.

The second or final examination for a commission, which generally ensues when the work of the Division School is over, is held in Berlin only, and is conducted immediately by the Central Commission, to which reference has so often been made,—the supreme Military Examinations Board, the *Ober-Militair-Examinations-Commission*. This Board or Commission, a list of the existing Members of which is given in page 88, consists, for the purpose now in consideration, of a President and five Examiners, selected from the larger number to examine candidates for Commissions.

Rules for Admission.

The examinations are held continually; two opportunities are afforded every year to the candidates sent from each of the various Army-Corps. The requisite papers must be forwarded to the Commission eight days at least beforehand, and the candidates must appear in Berlin, and take up their quarters in the buildings placed at the disposal of the Board on the Friday preceding the day fixed for the examination. The examination usually begins on the following Monday, and lasts through the week. The expenses of the journey are allowed, except, perhaps, when the candidate comes up a second time.

The certificates to be presented are the following :—

Certificates

1. The certificate of birth, age, parentage, &c. (This is called the *Nationale.*)
2. The *Curriculum Vitæ* (an account of the circumstances of the candidate's past life, his education, employment, &c. &c.)
3. The certificate that he has already passed through a previous examination (the *Tentamen*), held by the authorities of the Division School.
4. A certificate of conduct during his stay at the Division School.
5. A military drawing (*Croquis*), with an attestation given by his instructor that it is the candidate's own doing.

The Examination.

This examination, like the Preliminary one, is partly on paper and partly oral. General directions are given that the Examiners in both cases shall look mainly to the question whether the candidate has sufficient positive knowledge of his subjects, and capacity to explain and express himself, that mere lapses of memory shall not be regarded, and that natural endowments shall be principally looked to.

Paper Work.

In the written examination, the candidate has four questions given him in what is called the Knowledge or Theory of Arms (*Waffenlehre*), including under that term all kinds of Ammunition; three in Tactics; one question in the Rules and Regulations which touch the duty of a Subaltern Officer; two questions in Permanent and two in Field Fortification; one exercise in Surveying, to test his acquaintance with the common instruments, and one to try his knowledge of the principles of plan drawing (*Terrain-Darstellung*); while his

general skill in military drawing is proved by his either copying a plan placed before him, or drawing one from a relief model of a mountainous district (*nach Bergmodellen*).

Vivâ voce Examination.

There is a *vivâ voce* examination in all the subjects.

The Commission meets once every month to consider the examinations held since their last meeting. The result is announced under the form of the *predicates* or epithets already more than once referred to. Honourable mention is accorded to an *excellent* examination, and mention to a *good* one. If there has been an unsatisfactory result in one of the subjects, the candidate may compensate for it by superiority in other subjects, but can only in this case be qualified as *satisfactory* (*befriedigend*), and an adequate knowledge of "Arms" and Tactics is regarded as indispensable in candidates for the Infantry or Cavalry, and in "Arms" and Fortification in those for the Artillery and Engineers. No superior work in other subjects is allowed to make up for a deficiency in these.

If a candidate's work is marked as *insufficient* (*nicht hinreichend*), he is sent back for another half-year, and if he has done *unsatisfactorily*, for a complete year of additional study, with leave to appear for re-examination after that interval. In a case of re-examination, the two last *predicates* (*nicht hinreichend* and *ungenügend*) entail final rejection.

Report submitted.

The Report of the Board is submitted to the King; the results are communicated to the various Corps. The announcements sent to the candidates state the predicates assigned to the various portions of their work. Those who have passed, receive certificates of being qualified for the Second Lieutenant's commission:—

Promotion; its Conditions.

This rank, however, is not immediately granted. A vacancy may be long in occurring, and must be waited for. Promotion is given according to their seniority on the list of Ensigns in the Regiment. Another condition must also be satisfied. When a vacancy occurs, the senior Ensign's name cannot be submitted to the King for his appointment without a document stating on the part of the Officers of the Regiment that he has the requisite knowledge of the duties of the service, and that they consider him worthy of admission amongst them (*würdig in seine Mitte zu treten*). If the majority is opposed to his admission, the name of the next Ensign in order of seniority is, without further discussion, brought forward; if a minority or merely some individual Officers take exception, they state the grounds of their opinion, which are then submitted for consideration.*

Special merit in the examination may be, at the King's pleasure, held a sufficient reason for promotion before all candidates examined at the same time.

Programme of Studies required for Officers Examination.

The following is the programme of the studies, proficiency in which is expected of candidates at the Second or Officer's Examination:—

I. Knowledge of Arms and Munitions.

A. *Of Gunpowder.*

1. General views on gunpowder and its application.
2. Ingredients of gunpowder; its qualities and use.
3. Fabrication of the same; principles on which the manufacturing process is based.
4. Statement of the various kinds of gunpowder in use, and their distinctive qualities.
5. Of the ignition, combustion, and power of gunpowder.
6. Qualities of good powder; examination of the same:
   - *a.* According to their external characteristics.
   - *b.* According to force developed.
     - *α.* By the mortar eprouvette.
     - *β.* By the smaller eprouvette.
     - *γ.* Or, in default of such instruments, by practical experiment
7. Manner of preserving gunpowder; characteristics and treatment of damaged gunpowder.
8. Precautions to be taken in working with gunpowder, and transporting the same.
9. The most ignitible materials for percussion caps, and the like.

B. *Of Artillery.*

1. Classification of guns, according to species, calibre, and the kind of warfare for which they are intended. (Field, siege, and standing artillery.)
2. General qualities to be required of a properly constructed piece of ordnance.

* This certificate, according to a statement received in conversation, is in the first instance from the Officers of the Company, to the effect that the Ensign in question is well conducted and likely to be a desirable addition to their number; then from the Major of the battalion, and from the Colonel of the Regiment.

Programme of Studies required for Officer's Examination.

3. Construction of the piece; description of the same according to the various kinds of guns, specifying the use of the different parts. (An exact statement in figures is only called for in reference to the length, weight, and diameter of the piece.)

a. Materials; qualities required of them; enumeration of the materials generally employed.

b. Interior construction of the piece; length of bore, chamber, windage, and touch-hole; their influence on the range.

c. External construction of the piece; appliances for pointing and managing it, and connecting it with the gun-carriage.

4. Construction of the gun-carriages; enumeration of the different kinds of the same, according to the description of gun, its destination, and materials.

a. Specification of the principal component parts of the carriages.

b. Distinctive characteristics of the construction of the various denominations of carriages.

c. General principles for determining the proper construction of the same.

d. General notions relative to the proportion of the weight of the carriage to the piece.

5. Construction of the limbers.

a. Enumeration of the different kinds of limbers.

b. Principal component parts and distinctive characteristics of the construction of the various kinds of limbers.

c. General notions relative to the weight of the limber in proportion to the piece and the gun-carriage.

6. Statement of the various descriptions of waggons used by the field artillery, and their destination.

7. Ammunition; enumeration and description of the objects belonging to it. (Exact statements in figures are only required for the diameter and weight of the principal kinds of projectiles.)

a. Projectiles; statement of the species of projectiles used for the different kinds of guns, and their construction.

α. Round shot, cannon ball, grape.

β. Shells; their various species.

γ. Light balls.

δ. Stones.

b. Charges; general description of them.

α. In field-pieces.

β. In heavy artillery.

c. Primings; enumeration and description of the various kinds of primings.

d. Other military fireworks; statement of the principal species, and their general construction.

e. Transport of ammunition by limbers and carts; packing of the same.

8. Moving and working the guns:

a. General notions on the working of field-pieces.

b. Different kinds of operations with field-pieces; unlimbering and limbering up.

c. Position of field-pieces in firing, with regard to effect, cover, and celerity of movement.

d. Principal manipulations in working the same.

α. Loading.

β. Pointing.

γ. Discharging; the process according to the different kinds of projectiles.

e. Ascertaining the efficiency of a gun previous to using it.

f. Momentary unserviceability of guns.

g. Expedients for repairing a disabled carriage.

9. Artillery practice.

a. Exposition of the theory of firing (as far as it can be elucidated by a knowledge of the elements of mathematics); general notions concerning the curve of round and hollow shot, and the influence of the force of powder, of gravity, and of the air's resistance upon their velocity; the curve after the first graze; trajectory of grape shot.

b. Classification and denomination of the various methods of firing or throwing projectiles.

c. Range; conditions on which it depends; its practical limits.

d. Effect of projectiles.

α. Probable accuracy of practice; circumstances on which it depends.

β. Force of the blow; circumstances on which it depends.

e. Recoil, jumping, or bouncing; explanation of such occurrences.

f. Application of the various descriptions of guns, projectiles, and methods of firing, according to the nature of the mark, the distance, the position of the adversary, and the ground.

Programme of Studies required for Officer's Examination.

C. *Of Small Arms.*

1. Classincation and denomination of small arms.
2. General principles applied to the construction of the musket, the infantry and wall-piece rifle, the carbine, the cavalry rifle, the pistol, and the engineer musket (if the candidate is in the engineers).
3. Description of their construction and arrangement in particular; enumeration ot the separate parts (an exact statement of dimensions only required for the principal ones); object and effect of the same.
4. Estimate of the practical utility of the various kinds of fire-arms as employed by one infantry and cavalry (no technical or theoretical investigation, but only practical remarks).
5. Ammunition, as the ball, cartridge, and patch:
   a. Its preparation.
      α. In the usual manner.
      β. In cases of need, in default of the usual implements.
   b. Preserving, packing, and transporting it, both in carriages and by the soldier himself.

Management of small-arms:
   a. Theory of firing (in its general scientific bearings, *vide* Artillery) as applied to small arms; repeated elucidation of the curve, line of metal, axis produced, and the relative position of these three lines in the different ranges.
   b. Practical rules for loading, presenting, taking aim, and discharging, at different elevations of the adversary, and at different ranges.
7. Cleaning and preserving the arms.

D. *Of Side Arms.*

1. Classification and denomination of the same:
   a. Cavalry side arms.
   b. Lances.
2. Statement of the general principles on which their construction is based.
3. Examination of the state of side-arms on receiving them (within the limits mentioned above in C. 4).
4. Effect and management of the same.

II. Tactical Branches.

A. *Army Organization.*

1. General sketch of the organization of the Prussian army.
2. Characteristics of the different kinds of troops (arms); their peculiarities (their weapons are included under the former head), their equipment and destination.

B. *Elementary Tactics.*

1. Account of the regulations concerning the distribution and formation of a battalion of infantry, a regiment of cavalry, and a battery, in line or column.
2. Formation of the different columns from the line, forming square, deploying and forming line, movement in advance, to the rear and to the flank, changing front and direction in line and column.
3. Formation of *tirailleurs* and skirmishers; posting, covering, moving, reinforcing, reducing, and relieving the same.
4. General rules on the conduct of the separate arms in action.
   a. Engagement of infantry under fire and hand to hand, in close and extended order, in attack and defence.
   b. Charge of cavalry, attack *à la débandade*, wheeling off of the fourth subdivisions (platoons), skirmishing.
   c. Employment and conduct of artillery in action.
5. General principles relative to the combined action of the different arms.
6. Tactical advantages of ground; level, hilly, open, close, unenclosed, and broken ground.
7. Attack and defence of localities, such as heights, woods, farm-buildings, villages, and defiles; false attacks, demonstrations.

C. *Field Service.*

1. Of Marches. General rules, method, and object; precautions, van and rear guards, covering parties.
2. Escort of transports of powder, provisions, and prisoners of war, in one's own and in an enemy's country.
3. Surprises, ambuscades, and reconnaissances.
4. Service in cantonments, camp, and bivouac, outposts, picquets, advanced picquets, reserve picquets (moveable and stationary), patrols.
5. Taking up quarters in ordinary marches and cantonments.

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III.—Fortification.

A. *Field Works.*

1. Object of breast-work and ditch profiles in plains. Plan of field-works; open works, salient angle, its dimensions.

2. Dead angle and dead ground. Removal of dead ground; flanking; line of defence; dimensions of re-entering angle.

3. Enclosed works; dimensions and space enclosed; works with salient angles only, and with both salient and re-entering angles.

4. Erection of works to be defended by artillery; firing *en barbette*, and through embrasures; platforms; magazines.

5. Communication with interior of enclosed works.

6. Artificial obstacles for strengthening field-works; requisites for their selection and application; method of construction; advanced ditches (demi and entire); trous-de-loup; abattis; palisades and fraises; barriers; chevaux-de-frise; pickets; caltrops; harrows; sluices and inundations; fougasses; block-houses; caponiers; double, single, and demi-caponiers *à revers*.

7. Strength of garrison of field-works.

8. Defilading, horizontal and vertical, of open and enclosed works; traverses and bonnettes.

9. Construction of small open and enclosed field-works; marking out; tracing; profiling; number and employment of workmen; excavating the ditch; formation and revetment of the slopes with sods, fascines, wicker-work, gabions, sand-bags, wood, or stones; selection, preparation, and application of the reveting materials. (Of the execution of the revetment only so much as may show whether the Examinee will be capable of undertaking the direction of such works in an efficient manner.)

10. Fortification of heights and defiles.

11. Object, general arrangement, and advantageous situation of a tête-de-pont.

12. Arrangements for the defence of woods, hedges, houses, churches, and churchyards.

13. Attack and defence of a redoubt; surprise; attack by open force.

14. Repairing and destroying roads, fords, and bridges, wooden and stone; construction of foot bridges, carriage bridges, bridges across swamps.

B. *Permanent Fortifications.*

1. Construction of a bastioned front in a plain, with ravelin, tenaille, and covered way, in plan and profile, after the first system of Vauban, with the improvements of Cormontaigne; name and destination of every single part, angle, and line.

2. Brief description of a regular attack upon a bastioned fortress; sketch of the preparations for attack; lines of circumvallation and contravallation.

Description of parallels, approaches, demi-parallels, and the duties of the infantry in them; saps, trench cavaliers; carrying the covered way, crowning the glacis, passage of the ditch, escalade of the rampart. These operations to be detailed according to their object, position, and arrangement, but without special reference to their technical execution.

General notions relative to the batteries of a besieging army, their position, object, calibre of guns, and practice.

3. Outlines of the system of defence of a fortress relative to the employment of infantry and cavalry in garrison, and of the standing artillery in arming the fortress and placing it in a state of defence against a regular attack or an attack by open force in all its stages.

Especial knowledge of the duties of infantry and cavalry in garrison, in guarding, occupying, and defending the works, and in sallies, required.

4. Historical sketch of an actual siege (on which the examinee has attended a lecture), and the principles of the attack and defence of fortresses in general.

5. Account of the situation, form, arrangement, and object of some of the means employed for increasing the permanent strength of fortresses, exclusive of the more technical points.

a. The rampart of the body of the place. Angle of the bastions and its effect; length of flanks and faces; auxiliary flanks; empty and solid bastions attached and detached fausse-brayes.

The escarp, earthen wall, revetment, demi-revetment, simple crenneled wall, arched crenneled wall, revetment *en décharge;* perpendicular and parallel casemates.

b. The main ditch, dry, wet, and dry or inundated at pleasure; sluices, coffer-dams, reservoirs.

c. Outworks. Ravelin, tenaille, counterguards, cover-faces, envelopes, tenaillons, lunettes.

d. Advanced works. Simple and double tenaille; horn-work before a bastion or redoubt; crown-work double crown-work; advanced ditch, with advanced covered way.

e. Detached works, open or enclosed at the gorge.

f. Interior works. Cuts inside the bastions; réduits; citadels.

6. Historical notions of the characteristics of some of the principal systems of fortification, *e.g.* the old and modern Italian, the old Dutch, Vauban's second and third manner, the ideas of Coehorn, Rimpler, the French school, and that of Montalembert, compared with

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Vauban's first system, but without statement of proportions; in addition to this, the characteristics of the latest Prussian fortifications, always with the omission of details more especially technical.

7. Modified methods of attack; surprise, assault, bombardment, blockade; explanation and statement of circumstances in which attacks of this kind are practicable.

IV. Surveying and Drawing Plans.

1. Knowledge of the instruments generally employed in military surveying, and their use.
   - *a.* Instruments for measuring and marking out straight lines, viz.—
     Signals, bandrols, or *jalons*, common staves, picket posts, rods, measuring chains, measuring cord, the step.
   - *b.* Instruments used for protracting the lines measured, viz.—
     The step measure, calliper compasses, beam compasses, dividing and reducing compasses.
   - *c.* Instruments for measuring and marking out horizontal angles:
     The square, the plane table, caloptric compasses, the reflector, the sea-compass, the prismatic compass, the astrolabe:
   - *d.* Instruments for measuring vertical angles:
     Lehmann's dioptric rule, Schmalkalder's holometer, the quadrant.
   - *e.* Levelling instruments:
     The ordinary mason's level, the spirit level, the water level, the spirit level *à lunette*, the plumb rule, Lehmann's dioptric rule in connexion with the plane table, placed horizontally, the surveyor's rule, Schmalkalder's holometer.
2. Operations in surveying with the plane table, astrolabe, reflector, and compass.
3. Topographical survey of a locality (theoretically and practically), reconnoitring, geometrical triangulation, detailed survey.
4. Hasty or rough sketch of certain objects, and entire (but limited) sections of country.
5. Drawing plans.
   - *a.* Notion of the elements of topography; rising and sloping ground, running and standing waters, division of ground in a military point of view, and characteristics of the same; open, enclosed, elevated, hilly, mountainous, broken ground.
   - *b.* Theory of plan drawing.
     - *α.* The first elements of the science of projection, and the construction of instruments for measuring slopes.
     - *β.* Fundamental rules for plan drawing in general, and for drawing mountains in particular. Statement of the various angles of depression of inclined planes through mountainous regions.
     - *γ.* Of the horizontals, and the laws dependent upon them, relative to mountainous districts.
     - *δ.* On the laws of defiles.
     - *ε.* On ascertaining the difference of elevation, and drawing profiles.
     - *ζ.* View of the accessories of plan drawing; the choice of colours and of type, and the order in which the operations necessary for preparing a plan are performed.
   - *c.* Practical plan drawing from copies and models.

V. Military Composition and Knowledge of the Service.

A. *Exercises in Military Composition.*

1. Drawing up reports on incidents connected with the service, and with the duties of a Subaltern Officer, directed to the military authorities and Superior Officers of every rank.
2. Instructions to subordinates.
3. Applications and memorials.

B. *Acquaintance with the General Regulations of the Service.*

1. The laws on disciplinary and military punishments.
2. The proceedings in courts-martial, drum-head courts-martial, and courts of honour.

Means by which preparation is made for the Examination Division Schools.

The preparation for this second, severer, and professional test that has just been described, is usually obtained in the Division Schools, of which an account will shortly follow, and to which any young man once accepted as a candidate, who has served his six months with the Troops, and has passed his Preliminary or Ensign examination, may be admitted, even though a vacancy has not yet occurred, and he has not yet received his definitive promotion to the Ensign's grade.

SECTION II.—1. THE CADET SCHOOLS OR CADET HOUSES.

(*Cadetten-haüser.*)

The actual Military Education of Prussia commences with the Cadet houses, the schools intended for pupils before entering the Army. They are divided into two classes, the junior and the senior. They cannot indeed be called exclusively Military Schools, since the education which most of their pupils receive is one which fits them for civil professions, and is not specially military: and there is no obligation even on those who have received the largest amount of pecuniary assistance to enter the military profession when they leave the Cadet House.* The highest class, however, of the Upper Cadet School of Berlin, called the *Selecta*, receives strictly military teaching for a year, and the schools may fairly come under this denomination, as being mainly intended to educate the sons of Officers who are in want of assistance, and as possessing a military discipline, uniform, and spirit. In fact Colonel von Holleben described the distinctive object of the Cadet Schools to be the encouragement of a military "*esprit de corps.*"

Cadet Houses, not exclusively Military Schools.

No engagement to enter the Military Profession.

These are five in number, four preparatory Schools, and one a finishing institution; the four first in the provinces, at Culm, Potsdam, Wahlstatt, and Bensberg, the last in the capital itself. At the four Junior Schools, boys may be admitted at 10 or 11, and may remain till 15; at the Upper School the ordinary stay is from 15 or 16 to 18 or 19.

Number of Cadet Houses.

The whole constitute together a single body, called the Cadet Corps. Boys may enter the School at Berlin on passing an examination without previously attending one of the Lower Schools; but those who are sent up by the authorities from Culm, Potsdam, Wahlstatt, and Bensberg, are received without examination, being already members of the Corps. A single Officer exercises the command of the whole (*Commandeur des Cadetten-Corps*); and a single Commission, of which the General Inspector (General Von Peucker) is Chairman, regulates all matters relating to the admission of Candidates into the body.

The Cadet Corps.

The whole number at present is between 1,100 and 1,200, of whom 420 are in the Upper School at Berlin, 205 in the Preparatory School at Potsdam.†

The Cadets are of two kinds, the King's Cadets and the Pensioners or paying pupils; the former are 720 in number, the latter about 420. The Pensioners pay 200 dollars (30*l.*) a year for board and instruction together; the King's Cadets are aided in various degrees accordingly to the following scale:—

King's Cadets and Pensioners.

Scale of Payments.

240 pay 30 dollars (4*l.* 10*s.*) each.
240 pay 60 dollars (9*l.*) each.
240 pay 100 dollars (15*l.*) each.

Foreigners are admissible at a yearly payment of 300 dollars (45*l.*), and a few extra day scholars (*Hospitanten*), when the classes are not too full, are received for 20 dollars a year (3*l.*)

The King's Cadetships are granted, according to the pecuniary circumstances of the applicants, to the children of Officers of the Standing Army, or of the Landwehr, who have distinguished themselves or have been invalided in actual service in the field; to the children of Non-commissioned Officers who have in like manner distinguished themselves and received severe wounds in the service; and to those of any citizens who have performed any special service to the State.‡ The sons of meritorious Officers who have died in indigence or have retired upon pensions, the sons of indigent Officers in general in the Standing Army, and the sons of meritorious Non-commissioned Officers of 25 years' standing, are also in like manner eligible.‖

Kings' Cadets.

Free Pupils.

Conditions of their Appointment.

In very special cases of poverty, the supplementary payment is dispensed with altogether.

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* Such an engagement was formerly exacted, but has now been abandoned.

† The numbers were given in general terms as follows:—Berlin, 420; Potsdam, 200; Wahlstatt, 200; Bensberg, 200; Culm, 160.

‡ One such case, we were informed, existed at the time of our visit in the Cadet House at Berlin.

‖ These last, in point of fact, do not appear to find their way to the Cadet Houses. There is always a large number of prior claims.

Pensioners or Paying Pupils.

Pensioners are admitted from all classes and professions according to priority of application, and to their qualifications as shown by their examination. A great number of these are said to be the sons of Officers, of those, namely, who are not in need of pecuniary assistance. And the number of the pensioners generally appears to be steadily on the increase. In the Regulations printed in 1850, the places open for this class of Cadets are stated to be only 216; at present, as has been seen, provision is made for something like double that number.

The series of Seven Classes in the Cadet Corps, from Sexta to Selecta.

The four Junior Schools at Culm, Potsdam, Wahlstatt, and Bensberg, are all divided for purposes of instruction upon the same uniform plan into four classes, numbered up from six to three—*Sexta* at the bottom; *Quinta; Quarta;* and *Tertia* at the top. The Upper School at Berlin succeeds with three classes, the Second, the First, and the Special or Select—*Secunda*, *Prima*, and *Selecta*. Each of these classes, however, may contain any number of co-ordinate subdivisions, all taught the same subjects, and presumed to contain pupils of the same capacity. No teacher, it is considered, can satisfactorily undertake to give a lesson to more than thirty at a time; and the Secunda at Berlin was thus parted out in the year ending March 1856, into eight little sets of rather less than thirty, the Prima into six, and the Selecta into two.

Junior Cadet House.

The Junior Cadet House at Potsdam.

The junior Cadet House at Potsdam occupies four or five buildings a little way out of the town. The Class Rooms are on the usual Prussian plan, not arranged for lectures to large, but for lessons with small numbers. One distinguishing feature is the character of the arrangements of the rooms upstairs, in

The Chambers.

which the boys pass their time out of school hours. They are very comfortable chambers, perhaps rather small for the numbers at present placed in them; they are ranged along a corridor; ten pupils are placed in each, and between every two rooms is the apartment of one of the Resident Tutors (*Erzieher* or *Gouverneur*), who sees that all goes on right in these two rooms under his charge. Here the boys sit and work, and during the hours when they are expected to be preparing their lessons, are carefully looked after by their tutors.

These little apartments occupy one whole floor of the building. The floor above is that of the dormitories, containing each, perhaps, as many as sixty. The number at present in the school was stated to be 205, and the accommodation properly intended for only 160. The beds were certainly more closely crowded together than the authorities would wish them to be.

At the hour of our visit, the afternoon lessons were nearly over; and, on coming down to the open space in front of the building, the boys were already out of school and at play. They all wore a plain uniform. A large party were in the Gymnastic Room busy at a variety of exercises, a part of them under the direction and by the example of an Officer.

Other Details.

Colonel von Rosenberg, the Commandant of the School, stated that eleven was the usual age at which the pupils came. This he appeared to think was rather too early, and he was inclined to attribute to this cause certain points in the character of young men who have been educated in the Cadet Corps. Eighty of his 205 pupils were Pensioners, or paying pupils; many of these also were the sons of Officers. The teachers and tutors are partly civilians and partly military men, about an equal number of each. The four classes, Tertia, Quarta, Quinta, and Sexta, are subdivided into nine, so that the average number at a lesson would not be more than twenty-three.

Senior Cadet House.

The Upper Cadet House at Berlin.

The Buildings.

The Upper or Central Cadet School is in the older part of Berlin, in the *Neue Friedrichs Strasse*, where on the pediment surmounting the gateway the inscription MARTIS ET MINERVÆ ALUMNIS M.DCC.LXXVI. records the erection by Frederick the Great, ten years before his death, of the large and stately quadrangle which formed the original House. Here the pupils are quartered, and in the great court within, they go through their exercises. There are several houses on both sides of the street attached to the service of the institution, and buildings are in course of erection to accommodate additional numbers.

A large separate building contains the present Class-rooms. In the first of these which we visited, thirty Cadets were engaged in Military Drawing; in another, twenty-four of the Second Class, the Secunda, were busy at their Latin lesson. The Class-rooms.

The room was fitted up on what appears to be the usual plan, with a series of parallel desks on the same level, ranged along the outer wall, and a sufficient space between them and the inner wall for the teacher to pass freely up and down. His desk was at one end in front of the boys. The lesson was in Quintus Curtius. The teacher (a civilian) made them construe each a sentence, and asked questions in parsing, &c. &c., much in the English manner. There was no taking places. This in German schools appears to be confined to quite the lower classes. There is a separate lecture room here again for lessons on Natural Philosophy and Chemistry, with a small gallery of models, instruments, &c. attached to it.

A large Hall is used on state occasions, and serves the purpose also of an Examination Room; it is called the Hall of the Field Marshals, and is adorned with portraits of the Sovereigns of Prussia from the Great Elector downwards, and of the Field Marshals both of the time of Frederick the Great and of more recent date, among whom is the Duke of Wellington. Here also is kept Napoleon's sword taken at "La Belle Alliance," and presented by Marshal Blucher. The Hall.

Passing to the first floor of the great quadrangular building, we found ourselves in one of the sitting-rooms of the Cadets. Seven boys had a couple of rooms, consisting of a common sitting-room, and a common bed-room. Five is the number for which this amount of accommodation was intended, and to five the number will be reduced when the new buildings are completed. In a second and larger pair of rooms we found twelve boys. The Quadrangle, the Chambers, the Library, &c.

Here also is the Library, containing 10,000 volumes, and comfortable apartments occupied by the various superintending Officers. Library.

The boys, their morning lessons completed, had been going through their military exercises under the superintendence of their Officers; but they were now collected in their studying rooms, and were seen forming at the doors, each small party under the command of its senior, ready to march into the large and handsome dinner-hall.

Into this the whole body of young men presently moved by companies, proceeding to station themselves in front of the tables. The tables are ranged in parallel lines on each side of the central passage, and accommodate each of them ten, four sitting at each side, and a senior at each end. The order was given by the Officer on duty for "prayer" (*Nun beten wir*), and a short silent grace was followed by the immediate occupation of the seats, and the commencement of the meal. The arrangements in general appeared to be excellent. Dining Hall.

The number in the School during the past year had been 420. The four companies into which the whole body of the pupils is divided, each contain a certain proportion from each of the three classes; the senior in each company being invested with the charge of the juniors; those who are in the Selecta taking rank as Under Officers. In every room (*Stube* or *Wohnzimmer*) there is one *Selectaner*, who is responsible. The ordinary ages are 15, 16 in the Secunda; 16, 17 in the Prima, and as far as 19 in the Selecta. No one is, as a rule, allowed to pass more than one year in a class; if in that time he cannot qualify himself for advancement, he is dismissed. The rule does not, however, appear to be strictly enforced. The general preservation of discipline appears to be a good deal intrusted, as in English public schools, to these senior pupils of the age of eighteen or nineteen. There are Resident Tutors (*Erziehers* or *Gouverneurs*) as at Potsdam, who see a good deal of the pupils, especially in the evenings, when they go into the sitting rooms, sit with them, help them in their work, play at chess with them, &c. &c. But they do not sleep close at hand between the sets of rooms, as at Potsdam, but at some little distance off. Composition of the four Companies. The Senior Pupils entrusted with the discipline.

The official arrangements for the control of the discipline consist principally in the system of what are called *Censur* Classes. This is a peculiar system which requires some explanation. There are five *Censur* Classes quite independent of the ordinary classes of the school. A boy on entering the Cadet School is always placed in the third of these classes; if he behaves ill, he falls to Class IV. and is under restrictions. Class V. is reserved for serious cases of misconduct, and any one who incurs the penalty of descending to it, is subject to continual superintendence, and is confined to the walls. Class II. gives The *Censur* or Conduct Classes.

considerable, and Class I. still more ample, privileges. The members of this class (usually only quite the elder boys) are allowed great freedom in the way of going out into the town, &c. &c.

In each of the studying-rooms (the *Wohnzimmer*) the list of the occupants' names hangs up on the door inside. One for example was noticed containing twelve names. To each was attached his rank in the *Censur* Classes, as well as his position in the ordinary classes. At the head stood one *Selectaner*, who in this instance was in charge of the room; then followed the *Primaners*; and the list was completed by nine of the *Secunda*. As at the time of our visit (just after the Easter holidays and the yearly examination) the whole Selecta of the year had just quitted, the room was in the charge of the senior *Primaner*. The authority exercised by these senior boys appears to be very considerable.

Other details.

The competition for admission to the Selecta, and for the after selection for immediate promotion, was spoken of as very considerable.

The number who come to the Berlin Cadet House without previously going to one of the junior establishments was said to be only a small per-centage.

The boys both here and at Potsdam were of course all found dressed in a military uniform.

Studies of the Cadet Corps compared with those of a Gymnasium, those of a *Real* School, and those of a *Real* Gymnasium.

The studies pursued in the Cadet Corps agree nearly with those of the common public schools, but of these there are three different kinds:—

i. The ordinary first-class school, the *gymnasium* of the Prussian States, is, strictly speaking, a school which prepares for the universities.

ii. The second-class schools have the name of *Real* or *Practical Schools;* they deal with the actual application to business and work, not with the theory of mathematics or of language, and they may be said to resemble in some degree the schools occasionally attached in English towns to Mechanics' Institutes. Young men who have passed successfully through a gymnasium may be admitted to the Army without passing the preliminary or *Portepée-fähnrich* examination. Those who complete their time at a *Real* School have not hitherto been allowed the same privilege.

With which last they are said most nearly to correspond.

iii. There is a third and intermediate class called a *Real* or *Practical Gymnasium*, and to this, according to the statements of the official books, the courses of the Cadet Schools have hitherto corresponded. It appears, however, that there is only one specimen of the *Real Gymnasium* now in existence, the Coëln School in the old town of Berlin. The system here is said to be more practical than the *Gymnasium*, and less professional or mechanical than the *Real School*.

It is intended during the present year to assimilate the course of instruction at the Cadet Schools more nearly to that followed at the *Gymnasium* or University School; the studies of the senior Cadet School at Berlin will be raised to a higher standard, but Greek and Hebrew, which are taught in all gymnasiums, will not be introduced.

The two systems have corresponded as follows:—

Class in the Cadet Corps.	Age.	Corresponding Class in the *Real* Gymnasium.
6th, or *Sexta*	12	5th, or *Quinta*.
5th, *Quinta*	13	4th, *Quarta*.
4th, *Quarta*	14	Under 3rd, *Unter-Tertia*.
3rd, *Tertia*	15	Upper 3rd, *Ober-Tertia*.
2nd, *Secunda* (at Berlin)	16	Lower Second, *Unter-Secunda*.
1st, *Prima*	17	Upper Second, *Ober-Secunda*.

The Selecta, the Military Class, corresponds with the classes of the Division Schools, and with the first year's course of the Artillery and Engineers School.

The plan pursued, both as regards, first, the subjects taught, and second, the amount of time, is as follows:—

Subjects of Instruction in the Lower Classes.

The instruction consists throughout, from *Sexta* up to *Prima*, of lessons in Latin, German, French, Arithmetic, History, Geography. Natural History begins in the *Quinta*, at 12 or 13 years old, with Botany and Zoology; Mineralogy follows, at 14 or 15; Natural Philosophy at 15 or 16. The first elements of drawing, with the use of rulers, compasses, &c., begins also in *Quinta*, at 12 or 13. Practice in regular plan-drawing is gradually and increasingly given in every year. The first elements of geometry are taught in the *Quarta*, and Euclid I. 47.

Pythagoras, has to be mastered at 14 years old. Theoretical Arithmetic, in combination with Algebra, is commenced apparently in the *Tertia*.

The subjects taught in the *Secunda*, *Prima*, and *Selecta*, that is, the course of the Upper School at Berlin, has hitherto been as follows:— In the Secunda, Prima, and Selecta.

In the Secunda:

Quintus Curtius, Cicero's Orations, and Ovid's Metamorphoses; in Mathematics, the completion of Plane and commencement of Solid Geometry; Quadratic Equations; the Physical, Statistical, and Ethnographical Geography of Europe; Ancient History, and History of the Middle Ages, down to the Thirty Years' War; a first course of Natural Philosophy; French and German Composition continued; Theory and Practice of Military Drawing.

In the Prima:

Livy and Virgil; in Algebra, Progressions, Logarithms, Exponential Equations; Trigonometry, Mathematical and pure Physical Geography in general; Modern History; second course of Natural Philosophy, Heat, Electricity, Magnetism, Sound, Light; French, Exercise in Speaking, &c.; History of German Literature; Composition, extempore Exercises; Military Drawing continued.

In the Selecta:

Arms and Munitions, and Artillery; Fortification, Tactics, Military Literature, Practical Exercises, Military Drawing and Surveying; exercises in French and German; Mental Philosophy; Chemistry; and the Differential and Integral Calculus for those who propose to enter the Artillery or the Engineers.

The Secunda have weekly— Amount.

6	hours	of Latin.
3	„	of German.
4	„	of French.
5	„	of Mathematics.
2	„	of History.
2	„	of Geography.
2	„	of Natural Philosophy.
2	„	of Lessons in Drawing.
2	„	of Religious Instruction.
2	„	of French Conversation.
Total - 30	hours	weekly.

The Prima,—

The same amount in Latin, German, French, Mathematics, Natural Philosophy, French, conversation, and Drawing; in History 3, and in General Geography 2, and Mathematical Geography 1; of Religious Instruction 1. 33 hours weekly.

The *Selecta* have—

4	hours	of Tactics.
2	„	of Military Literature.
1	„	of Military Law and Regulations.
5	„	of Artillery.
5	„	of Fortification.
2	„	of Plan Drawing.
2	„	of Mental Philosophy, or English.
2	„	of Chemistry.
2	„	of Mathematics.
2	„	of French.
2	„	of German.
Total - 29	hours	weekly.

The lessons appear to be going on from 8 to 11 or 12 in the morning, and from 2 to 4 or 5 in the evening. The pupils have two hours drill twice a week. They get up at half-past 5, have breakfast, and an hour's preparation before lessons begin. There are similar hours of study in the evening from 6 to 8; and some of the pupils also take private lessons from the Teachers.* During these special hours of study (*Arbeitstunde*), the chambers are visited by the Officers and Tutors, assistance is given and diligence enforced. From 8 to half-past 9 they study as they please; the Tutors are a good deal with them in the rooms; at 10 all are in bed. Wednesday and Saturday are half holidays; on Sunday they attend morning service in the garrison church, and after that is Hours.

* Not from the Tutors, but from the non-resident Professors and Teachers.

over, are allowed to be more or less absent in the town, to be with their parents, relations, and friends.

Number of Teachers.

For the 420 Cadets of the Institution at Berlin, there appear to be about twenty Professors and Teachers not residing in the school, the majority of whom are civilians; and in addition to these, twenty Tutors and Superintendents resident in the buildings. Of these, sixteen are Military Officers, half of whom are permanently attached to the Corps, and half on duty from various Regiments, and four are civilians. The Cadets being divided into four Companies, each containing so many of the Selecta, so many of the Prima, and so many of the Secunda, to each of these Companies are attached one Captain, one First Lieutenant, and two Second Lieutenants, all of whom, however, take some part in the instruction; and one civilian (*Civil-Erzieher*) is added with the especial duty of looking after and assisting the studies of the Cadets of the Company.

Holidays.

The holidays are one month in summer (in July and August), ten days or a fortnight at Christmas, eight days at Easter, and four at Whitsuntide.

Departure of the Cadets.

At the time of our visit the ordinary annual examination for the admittance of Cadets into the Army was going on. The two highest classes (the *Primaner* and *Selectaner*) were either actually under examination, or were at home awaiting the result. During the month of April, the last month of the school-year, only the second class (the *Secundaner*) would be present. The 1st of May would inform the departing Cadets of the result of their examination; would elevate the Cadets of the present Secunda to the rank of the Prima, and would bring a new promotion from the provincial institutions to form, together with any pupils admitted from places of civil education, the Secunda of the coming year.

Rules of Entrance into the Army: 1. The Cadets who leave from the *Prima*.

The rules for the entrance of Cadets into the Army are as follows:—Those who complete their year in the Prima are considered to be sufficiently prepared for ordinary admission. They are sent in to an examination before the Supreme Examinations Board (the *Ober-Militair-Examinations-Commission*), before Examiners entirely independent of and unconnected with the instruction of the Cadets; and the majority, if they pass, are admitted simply as *Portepée-fähnriche*, on the same conditions as the young men already spoken of who enter upon the recommendation merely of the Commanding Officer of a Regiment and the approval of the Commanding Officer of an Army Corps. Like these, they serve in the Regiment, they attend the Division Schools, and in due time offer themselves for examination for a commission.

2. The Cadets who remain for the *Selecta*.

Out of this number, however, the sixty who do best are retained, and reserved to receive in the Special Military class of the Cadet School the instruction which the others are to seek in the Division Schools. These remain another year in the Cadet House, and undergo at its close, before leaving the Cadet House, their Officers' Examination before the Supreme Board. The thirty best are once more selected, and receive immediate promotion. Their patents are signed and they join their Regiments at once as Second Lieutenants. The other thirty, if they have satisfied the Examiners, receive a certificate of qualification, and enter with the rank of *Portepée-fähnrich*, and with the prospect of receiving commissions without further examination, as soon as vacancies occur. Any one who fails to pass his Examination must enter, if at all, simply with the rank of *Portepée-fähnrich*, and has to qualify himself in the Division Schools for attempting a second time the examination for the Officer's patent.

Nature of the recent change in these Regulations.

Such is the system as recently modified. Till quite lately only thirty were promoted from the Prima to the Selecta, and these thirty, unless they failed wholly, obtained immediate commissions at the end of the year. It has been found desirable to introduce the stimulus of competition, to offer a definite reward in the way of superior advantages to the best students, and to make it obviously worth a young man's while to exert himself, and to be thoroughly diligent during this final year in the Selecta at the Cadet School.

Case of Cadets who go into the Artillery and Engineers.

Young men who, after passing their Examination in the Prima, desire to enter the Artillery and Engineers, follow the usual course leading to the Artillery and Engineers School. They enter an Artillery Regiment, or a Division of the Engineers; they serve for nine months, they enter the special School, they are eligible after the first quarter to the grade of *Portepée-fähnrich*, and at the close of their first year are examined for their Lieutenant's commission Those who remain in the Selecta have the great advantage of passing from the Cadet School immediately into the Artillery and Engineers' School as

Lieutenants, and commence their course there accordingly at the beginning of the second of the three years. As, however, the school-year closes at the end of April in the Cadet Houses, and begins in the Artillery and Engineers' School on the 1st October, these select Cadets also pass five months with their Regiment in actual service before recommencing their studies.

The average number who pass in this manner into the Artillery and Engineers School is stated by the authorities of the Cadet House to be three annually from the Selecta, and six or eight from the Prima.

Non-military character of the instruction given in the Cadet Houses.

It can hardly have escaped observation, that the studies pursued as a qualification for entering the Army are, with the exception of the Selecta, almost entirely non-professional, even here in this part of the general system, which is in other respects most military in its character; and the tendency seems to be to carry out to a still greater extent the theory of continuing to as late an age as possible a good general education. There is evidently a general desire in Prussia to take the Officers of the Standing Army exclusively from the well-educated or the higher classes.

Comparative absence of competition.

In the arrangements for the lessons, the very temperate or even timid use of the stimulus of competition deserves to be noticed. It appears, however, to have been lately employed with advantage in the highest class. At the same time, the provision made for giving really good instruction, and for placing all the boys in close relation with their Teachers, cannot but excite admiration. The small numbers of which the classes consist, and the care which seems to be taken in providing good Teachers, both deserve attention.

Domestic character of the Arrangements for Sleeping and Living.

The domestic arrangements, without being remarkable for the scrupulous cleanliness or the magnitude of the new institutions in Austria, certainly in some respects are more in accordance with English feelings. The greater privacy afforded by the use of rooms where few live together, is certainly more analogous to what has been found most desirable for English boys in large English schools, though most likely the contrary system is not less well-adapted to the national character in France and in Austria.

SECTION II.—2. THE DIVISION SCHOOLS.

(*Divisions-Schulen.*)

The Division Schools in Nine Garrison Towns.

There are nine Division Schools for the whole Army, one for each Army Corps, and they are placed at the following towns:—Potsdam, Königsberg, Stettin, Frankfort on the Oder, Erfurt, Glogau, Neisse, Münster, and Trèves.

The Teachers and their Pay.

Here the young aspirant finds himself with nine or ten companions and a body of teachers amounting to about half that number, appointed by the Commanding Officer of the Army Corps, and differing considerably in different districts in their talents and ideas of education. They are often, though not always, selected from Officers who have been at the Staff School and afterwards at the Topographical Bureau. Their additional pay for teaching is uncertain; it depends upon the surplus remaining after the expenses of the household, and the money paid in purchasing books, instruments, &c., are deducted from the yearly allowance made to the School by the Government. At best it is not high. It is calculated by the number of lectures, and at the most amounts to something more than 4*l.* 10*s.* (30 thalers) for the lectures on a single subject, given, it must be remembered, during the course of little more than six months in the year. The highest pay given in the Potsdam School to any one Professor amounted to something more than 15*l.* (100 thalers) yearly for lectures on three subjects, averaging ten or twelve lectures weekly for about six months. This must be estimated by a Prussian, not an English standard, being nearly equivalent to five-twelfths of the annual pay of a Second Lieutenant in that Service. Still the sum is very low; and this, with some other obvious deficiencies, injures the working of the Schools.

Nature and subjects of the Instruction.

The young candidate for a Commission begins a course of Tactics, Fortification, theory of Drawing and Surveying, Military Literature, Artillery, &c., Military Essays, and Drawing of Plans, which must be finished at the School in nine months, although it may be continued longer in private if the candidate is not prepared to pass his examination. As long as it lasts, twenty-three hours a week are devoted to study, besides the time occupied by questions, which the teachers are required to set from time to time, in order to keep up the pupil's previous knowledge of French and Mathematics. The course is divided into the purely theoretical and the practical divisions, the first of six and a half months, the latter of two and a half. We have already given a very full account of the studies in pp. 94 to 98.

Theoretical and practical.

Theoretical Studies.

The arrangement of studies is systematic, and the number of hours devoted each week to lectures on the various subjects of study and to gymnastic riding and fencing, is as follows:—

WEEKLY:

	Hours.		Hours.
Fortification	4	Plan drawing	5
Artillery, &c.	3	Gymnastics	2
Tactics	4	Riding	2
Military Surveying (theoretically)	4	Fencing	2
Military Literature	2		
Instruction on Military Duties	1	Total	29

Daily routine.

The subjoined Plan gives the exact employment of Time for each day during the week:—

PLAN of LECTURES at the DIVISION-SCHOOL in POTSDAM, 1855-6.

Hours.	Monday.	Tuesday.	Wednesday.	
8 — 9	Fortification	Military Literature	Tactics	Dinner time, 3 o'clock. Time for studying, from 6 till 8 o'clock, or from 7 till 9 o'clock every evening.
9 — 10				
10 — 11	Instruction on Military duties.	Artillery, &c.	Plan drawing	
11 — 12	Plan drawing	12½–2½ Gymnastics		
12 — 1				
	Thursday.	**Friday.**	**Saturday.**	
8 — 9	Fortification	Artillery	Tactics	
9 — 10				
10 — 11	Military Surveying (theoretically).	Plan drawing	Military Surveying (theoretically)	
11 — 12				
12½— 2½	Riding	12½–2½ Fencing		

The lecturer has to draw up what is called the thread of the lecture (*leitfaden*), a sort of program containing its leading heads, intended to assist the memory of the pupils in giving a full account of it afterwards; and the contents of the different lectures on Tactics, Arms and Munitions, Fortification, &c. are written out very minutely by the students. Ten pages of close print are devoted to these programs in Helldorf; and the translation already given (pp. 94 to 98) will show that the list of military subjects adverted to is considerable. Method of teaching.

At the end of the nine months spent at the Division School, the "*Officier Aspiranten*" go to Berlin for the examination for their commission. If they cannot pass this, they return to study by themselves for their second trial. Unless by special permission from the King, they cannot try more than twice.

The examination is conducted by the Supreme Commission for Examinations at Berlin, and has been already described.

The Division Schools were founded at the end of the great War. Their germ appears in Scharnhorst's general order in 1810, which, among other things, instituted three War Schools for the candidates for Commissions (*Portepée-fähnriche*). These three War Schools seem to have been changed into the Division Schools in 1813 and 1816. At first, indeed, they were much more numerous than at present, as their name implies, there being two Divisions to each Army-Corps. There are now, as we have mentioned, nine; and Corps School or Army-Corps School would be the more correct designation. Remarks. Foundation of Division Schools.

Their importance as the institutions for special military instruction to all "*Officier-Aspiranten*" of the army led us to inquire carefully with regard to their efficiency, and in particular from two distinguished Officers, on whose judgment and scientific experience great reliance might be placed. One of these, it may be added, possessed constant means of knowing all the details respecting them.

I. Formerly, it appears, it was not possible to limit these Schools to their true object, purely military instruction. This was the special object of their creation; but owing to the defective *general* education which candidates often brought with them into the Army, the Division Schools were too much used as a means of meeting this deficiency. Difficulties hitherto experienced in working the Division Schools.

II. The opinions we obtained were certainly not favourable with regard to the present efficiency of these Schools. It seemed to be agreed, that from various reasons, the military education given was susceptible of much improvement; that some of the Division Schools were really defective in teaching, whilst none could be pointed to as strikingly good. But it was also admitted that these blemishes arose from remediable defects in the working of the Schools; that their principle was in itself sound, and capable of being carried out more perfectly, and excellently adapted to the object of giving some military instruction to all desirous of becoming Officers of the Infantry and Cavalry. Opinions, that there are some defects in the present working of the Division Schools.

III. The causes assigned for the present defects in the efficiency of the Division Schools were chiefly the following:—

(*a.*) That they were far too numerous. Their Number is too great.

Educated and scientific as Prussia may be called, it is not found practicable to supply *nine* Army Schools with exactly the sort of men fitted for the work of education. The pay, it must be added, is insufficient to attract many, and thus (as we were informed), although many Officers of intelligence are sometimes not unwilling to leave the life of drill for the life of education for a year or two, few do so with the serious purpose of doing it *well*. Neither the position nor the emoluments tempt them to make it a profession. Officers in command of the district have made the appointments, and often have "good-naturedly," as it was said, appointed unfit persons, known as studious men. This makes it hard to obtain good Teachers. Affecting the Appointments in the Schools.

(*b.*) The small number of pupils in each School was also spoken of as a very great disadvantage, as doing away with all emulation amongst themselves. Scanty number of Pupils at each School.

(*c.*) The independence which each school has enjoyed, and the want of any central body to watch its working and regulate its system, is also said to have had bad results. The teaching has been far from uniform,—in one school energetic, in another lax; in one school the most important subjects taught, in another, a little of everything; in a third, some special crotchet of a teacher. This has acted badly on the examinations, since it was thought hard to reject an "*aspirant*" who had done parts of his work well, and had been evidently ill taught or superficially instructed in others. Separate Schools left too much to themselves.

The remedies suggested were,—

(1.) Considerably to diminish the number of these Schools. This, we were told, was about to be done by reducing them from *nine* to *three*. Such a

course would obviously tend to remedy two of the evils complained of. It would give a larger choice of teachers, and afford more liberal means of remunerating them, and a larger attendance and competition of pupils.

(2.) To place the Schools under the more direct regulation and management of the Central Educational Department at Berlin. This step would improve their teaching by subjecting it to constant inspection and reports. It would insure uniformity in the system of instruction and subjects of study; and, when combined with the presence of abler teachers, it would enable the Board of Examiners at Berlin to pursue a more strict and unvarying course in rejecting ill-qualified candidates. By these means the teaching in the School would probably become more definite and higher.

Difficulty arising from the time for attending the School.

One other point was mentioned to us as doubtful. It was thought that the time for attending the Division School came too soon after a young man's entrance into the Army, when he had but recently obtained his liberty, and was likely to be much more unwilling to be sent to school again than might have been the case a year or two later. General von Willisen, who urged this objection to us, was consequently for deferring the attendance at the Division Schools several years in an Officer's life.

We should add, however, that as in Prussia a young *Officier-aspirant* is still partly a private soldier, we were told that many were glad to exchange the severity of regimental discipline for the Division School.

SECTION II.—3. THE UNITED ARTILLERY AND ENGINEERS SCHOOL.

(*Vereinigte Artillerie und Ingenieur Schule.*)

Course of Admission as Candidates in the Artillery and Engineers, similar in general to the usual course.

Young men desirous of obtaining commissions in the Artillery or the Engineers follow the course which has already been described. They join either with a nomination from a Colonel of Artillery or Engineers, or as scholars from the Cadet House. They submit themselves for examination for the grade of Ensign (*Portepée-fähnrich*); they serve their time with the troops, they go through a course of professional study, and are examined in it for their Officer's commission by the Board at Berlin. If they come from the highest class, the *Selecta* of the Cadet House, they have the privilege of joining the corps with the rank of Officer.

In these respects the system is the same for them as for the *Aspiranten* in the other arms of the service.

Points of Difference.

The distinctions are, that first, in the Preliminary or Ensign's Examination, a somewhat greater acquaintance with mathematics is required from them; secondly, that they prepare for the Officer's Examination, and follow their professional studies, not in the Division Schools, but in a separate Special Arm School at Berlin. Moreover, nine months service with the troops, instead of six, is required before they can enter the Special Arm School. They enter it also with the rank only of Corporal, and are not eligible to the grade of Sword-knot Ensign until they have passed three months at least in the School.

Their Officer's Examination before the Supreme Board at Berlin takes place after nine months more, at the end of the first year at the school, and after passing they are eligible to the rank of Officer.

When a vacancy occurs their claim to an actual commission is considered, and the usual formalities are fulfilled. Their names are submitted for approval to the Officers of the corps, and with that approbation laid before the King; and they thus in due time obtain their rank as Sub-Lieutenants respectively of Artillery or of Engineers.

The Special-Arm Examinations.

This rank, however, is provisional, and their position is that of supernumeraries. Their education as Officers may be complete, but their education as Officers of Artillery or of Engineers has scarcely in fact commenced. They have before them a third examination, that of the special arm, their *Vocation-trial* or *Berufs-prüfung*. Or, more correctly speaking, they have not one but two to pass, for the third examination is divided into two stages, one to be passed at the end of each of the two years which yet remain of the course. It is only when these are completed, after a three years' stay, that the young man is finally allowed to join his corps as a Second Lieutenant.

Cases of failure, at end of first year.

Failure in the Officer's examination at the close of the first year is attended with the penalty of returning to the Corps and resuming service in the ranks with the troops. Whether or not the rejected student may be permitted to return after an interval to join again the classes of the first year, or after passing, upon a second trial, the Officers' examination, to enter the classes of the second year, will depend upon the extent of his failure.

At end of second year.

Failure in the examination at the close of the second year is similarly visited with the punishment of return to the Corps. As they have already passed the Officers' examination, they may endeavour to effect a transfer to a Regiment of the Line; or, under certain circumstances, they may be permitted to study privately in preparation for the third year's course, and may offer themselves for a second trial.

At end of third year.

If a student fails in his last examination at the close of the third year, he may be allowed, in like manner, under favourable circumstances, to re-enter the third year's classes, and try to qualify himself by an additional year of study, losing, of course, his seniority. Otherwise, he joins the Corps as a supernumerary, with the pay of an Infantry Officer, and waits till he can obtain a commission in the line.

Pay.

Candidates for commissions in the Engineers enter the Corps, it should be observed, originally as volunteers, finding their own clothing, and receiving no pay; but as soon as they enter the school they are regularly paid by the State,

and receive their pay in the usual course of the service from the Division to which they belong.

Studies.

The studies of the three years are arranged in accordance with the system that has just been described. Those of the first year are common to the two arms, and correspond, in a general way, with what is taught in the Division Schools or in the highest class of the Cadet House. Those of the second year are devoted to the special arm subjects. In Mathematics, Artillery, and Fortification, the lectures are common to the Artillery and Engineers; in Drawing they are divided.

In the third year a considerable separation takes place. Mathematics are still taught, and there is a special class of the most advanced students in the Differential and Integral Calculus, the Higher Geometry, and in Analytical Mechanics and Hydraulics; this, however, is purposely restricted to about one-third of the class, by raising the requirements, if necessary.

The course is divided in each year into the theoretical and the practical part. The year commences in October with the former, and the studies for the nine months succeeding are for the most part theoretical only. In June the examinations take place. July, August, and a part of September are given up to practical exercises. Something like the last three weeks of September are allowed for a vacation.

Reference to official Documents, see pages 134 to 153.

In the translation of the official books, the fullest particulars on all points connected with the School are given, pages 134 to 153.

Referring for all details to these complete and important documents, it will be enough if we add here, in the first place, a statement of the staff employed in the School, for government, management, and instruction.

Government and Establishment.

The general control of the School is in the hands of the General Inspectors of the two services, the Artillery and the Engineers. These two are the *Curators* of the School and form the *Curatorium*. They make their reports to the General-Inspector of Military Education, (General von Peucker), of whom mention has already been made. The immediate management is entrusted to a Director, who is a Field Officer of Artillery or Engineers, of the rank of Commandant of a regiment, and he has a Captain, appointed by the *Curatorium* as his Assistant.

There is a Board of Studies, of which the Director is Chairman, consisting of the Senior Professor of Mathematics, of the Instructors of Artillery and Engineering in the third Cœtus, and of an equal number of Officers of the two services named by the Curators.

Four Officers, three from the Artillery and one from the Engineers, acting under the Captain, are charged with the care of discipline and order; these are the *Direction* Officers.

There are twelve Military and eleven Civilian Professors and Teachers. Among the Military Professors and Teachers may be included any of the Direction Officers.

The examinations of the first year are conducted by the usual Board, the Supreme Military Examinations Board; but for those of the second and of the third year, there is a separate Board, chosen from the two services by the Curators, and otherwise unconnected with the School.

Numbers.

The numbers in the School vary from 216 to 240. In time of peace about five are yearly admitted for each regiment of Artillery, and two or three for each division of Engineers. The great majority have entered the army from the usual places of civil education, a few from the Prima of the Cadet House, on the same terms as the others, and a small number, who are usually among the best pupils in the School, from the Selecta, who come as Officers, and after a short service with the troops, enter the second year's classes, provided there is room, preference being always allowed to the students already belonging to the School, who have succeeded in passing the examination of the first year.

Buildings and Arrangements.

The Artillery and Engineers School buildings stand in Berlin itself, in the principal street, *Unter den Linden*, No. 74, near the Brandenburg Gate. They bear the following inscription: *Artillerie und Ingenieur Schule. Stiftung Friedrich Wilhelms* III. M.DCCC.XXII.

On the occasion of our visit to the school, we were allowed by the kindness of the authorities to be present at some of the lectures. The Students of the second year were attending the course on the History of the Art of War, and the immediate subject was an account of and criticism on the battle of Blenheim. The young men, about forty-five in number, were

ranged in desks facing the Professor, but not in the manner of an amphitheatre. The lecture was interesting, animated, and generally instructive; it was perfectly professorial in character, and the young men took notes. A class of the Students of the first year, thirty-five in number, were engaged in topographical drawing. The Artillery division of the third year students were in another room, listening to and busily taking notes upon a lecture (also professorial) on the construction of gun-carriages: the number was about forty-five.

Only the Students of the first year are lodged in the building; and owing to the unusually large number lately admitted, an adjoining house has been taken to afford additional room. The accommodation in general is rather limited. Two stories in the upper part of the building are occupied by the somewhat scantily furnished chambers; there appeared in some cases to be two young men to one room, in other cases four, or as many as six or seven to a bed-room and sitting-room. The Students who lodge in the building dine together in a mess-room; and there is a billiard-room, with coffee-rooms adjoining it, for the general use, looking out from the ground floor front into the Unter den Linden. There is a library, a small laboratory attached to the lecture-room employed for the subjects of Chemistry and Natural Philosophy, and a small collection of apparatus required for illustration of the latter subject.

Course of the Students after leaving the School.

On quitting the School, the Engineer Students, as soon as they obtain their Commissions, are employed for three years with a Division of Engineers; then for three years in a fortress to superintend buildings; and then again with a Division of Engineers. They are then eligible to promotion as First-Lieutenants.

The Artillery Students, in like manner, join and serve with their regiments.

Promotion in the Artillery is by regiments, in the Engineers it is general throughout the whole Corps.

We should not omit to call attention to the fact, that the only instance which has come to our knowledge of the promotion of *Officers in their own arm of the service*, being made contingent on their passing an examination, is to be found in the Prussian Artillery and Engineers. First-Lieutenants belonging to those Corps must pass an examination before they can be promoted to the rank of Captain. This regulation does not exist for any other part of the Prussian Service, and it is considered a great grievance by the Officers of those corps, as it may be exacted at the age of forty, from the most highly educated Officers of the Prussian army.

The pay of subaltern of Engineers is somewhat higher than that of the the Artillery, Infantry, and Cavalry. Above the rank of subaltern, the pay of the Artillery, Cavalry, and Engineers, is on an equality, but superior to that of the Infantry. The Engineers have, moreover, a prospect of employment of a civil nature when they return from active service; to lucrative positions of this kind they are not unfrequently appointed.

It should be mentioned before quitting the subject, that all the Officers of the Artillery and Engineers are bound, in consideration of three years' maintenance in the School, to serve a period of six years, before they can exercise the usual privilege allowed to Prussian Officers of withdrawing from the service.

SECTION III.—THE WAR OR STAFF SCHOOL.

(*Kriegs-Schule.*)

The War School (*Kriegs-Schule*) in Berlin has undergone many changes since its foundation in the time of Frederick the Great. It is now the Staff School of Prussia, *i.e.*, the only, or almost the only, means of obtaining a Staff appointment is by passing through it, and the education given is particularly intended to form Staff Officers. Its plan and methods of teaching differ, indeed, from the very commencement from the French Staff School, and bear much more resemblance to our own Senior Department at Sandhurst, with the exception that our Senior Department is not at present a necessary means towards a Staff Appointment.

Staff School, a Senior Department.

Thus the *Kriegs-Schule* does not take young men of twenty-one or twenty-two and educate them (like the *Ecole d'Application d'Etat-Major*) for the Staff and the Staff alone. Its pupils are men of twenty-five or twenty-six, Officers of three years' standing, or five years' service since their first entering the Army. At this comparatively ripe age they become candidates for entrance to the Staff School, and, if admitted, they spend there three years of laborious study, with no very brilliant prospects to crown it, as only a very small number obtain what may be called the lowest prize, admission to the Topographical Department; and out of these only two or three yearly of the most distinguished pupils gain the Staff. The rest return to their Regiments, and are employed as Adjutants or as Teachers in the Division Schools.

Age and standing of the Student Officers.

The process of entrance is as follows:—An Officer of three years' standing desires to go to the Staff School. Any one may send in his name as a candidate for the Entrance Examination to the Minister of War, having obtained a certificate from his Superior Officer that he understands his regular duty, has no debts, and is capable, both as regards his abilities and bodily strength, of making a good Staff Officer. Little difficulty is made about admission to become a candidate, nor is there any regulation to limit the number from any one Corps or Regiment, so that there may be often found in the Staff School more in proportion from the Infantry than the Cavalry, and *vice versâ*. Some Regiments, we heard, hardly ever send Officers to the school. Practically, indeed, the regulation requiring three years of active service bears hard upon the Artillery and Engineers in comparison with the other services; for, as the officers of these two corps only enter their own school after they have been near a year in the service, and spend three years there, they must have been in the Army nearly seven years before they can enter the Staff School.

Mode of entrance.

The candidate for the Staff School is examined in the capital of the province in which his Corps is stationed. The examination is early in April, and it is held at the provincial town instead of Berlin, in order to diminish expense. But the questions are sent from the Board of Examiners in Berlin,* and the same are given in the different provincial towns at one and the same time. The examination is much on the same subjects, and requires about the same actual knowledge as that which was passed at least three years before for a Lieutenancy, but owing to the difference of age, the questions are put and are expected to be answered in a much more scientific form than on the first occasion. Thus, we were told, such an essay as "Give an account of the wars of Francis I. and Charles V.," would at the *Kriegs-Schule* Examination rather be stated thus:—"What was the influence of these wars on the policy and religion of Europe?"

Entrance Examination.

The examination is entirely upon paper; it occupies from ten to twelve days of about five hours daily, the Superintending Staff Officer in the province presiding over it. But his business is limited to reading out the questions sent to him, and taking care that no books are brought in, or any improper means used.

Entirely on paper.

* The Supreme Military Examinations Commission (*Ober-Militair-Examinations-Commission*).

The answers to the questions have to go through a double ordeal, the military ones being first examined by some of the Staff of the General commanding in the province, and afterwards by the Commission of Examiners at Berlin. The final decision rests with the Chief of the Prussian Staff, who recommends the successful Officers to the Minister of War.

There is an average of sixty to seventy candidates yearly. Only forty of these can be taken. If some additional case seems meritorious, the Officer may obtain a promise of appointment, but his entrance is deferred. It is not uncommon to try more than once.

120 Student Officers at the School.

The entrance-examination passed, the School opens on the 1st of October, to continue its lectures, with a fortnight's break at Christmas and at Easter, till the 1st of June. It has its 120 pupils, divided into their three classes, one for each year, working (with only little of practical work) under Professors, military for the lectures of a military, and civil for those of a non-military character. No difficulty, we understood, is found here, as we had heard to be the case at St. Cyr, in enforcing the fullest attention to the lectures of the civilian Professors; each is respected according to his knowledge of the subject, and it would be thought as absurd for a Military Professor to undertake a non-professional subject, as *vice versâ*.

Character and extent of the work.

The method of working is that so commonly followed in the Prussian Universities, of listening to numerous lectures, and taking copious notes upon them Nearly five hours daily, from eight in the morning till one, are often continuously occupied in this manner; for although only twenty hours of attendance are absolutely exacted weekly (an amount which to our own students would seem more than ample) ten more are said to be necessary to enable an Officer to do any justice to the various subjects of which he is expected to show some knowledge at his examinations.

These lectures are usually read aloud; there is no questioning and answering. The student, after five morning hours, must spend at least five or six more in copying them out, or in writing an essay on the subject of some of the lectures. Of these one is given about every three weeks, but only on military subjects. They are carefully corrected and sent back to the student with the notes of his teacher, and their merit influences the final estimate of his whole work.

Examinations.

Besides this daily work, the examinations are at once a stimulus and a means of testing proficiency. These occur every three months, but the yearly ones are the most important. They are entirely upon paper. In the quarterly ones the papers are only given for two hours at a time daily, and take the place of two common lectures; in the other examinations they are daily for four or five hours. They are entirely essays upon the numerous subjects lectured on in the school, History of War, Philosophy, Tactics, &c.*

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* Perhaps there is no better way of giving an idea of the mode of studying than by a statement of some of the subjects of these essays. They have been supplied to us by the kindness of Lieutenant Berger, of the 28th Infantry, from whom we have received much valuable information on the subject of the School in general.

General Essays.

On Tactics:—1. A Prussian Division, added to which is,—
1 Regiment of Infantry,
1 twelve pounder Battery,
1 Cavalry Regiment,
is in retreat from Goldberg to Jauer (in Silesia). The enemy is following. A position is to be taken up to stop his advance, whatever his numbers may be.

A map of the position being given:—
(*a.*) Describe the position.
(*b.*) Draw up the troops.
(*c.*) Write an explanatory criticism.
(To be worked at home in two days.)

Three Corps d'Armée march against Berlin from different points. The army in Berlin is ordered to meet them. (To be done in five hours.)

Permanent Fortification. For what purpose are the fortifications in the main ditch intended, and how are they to be constructed? (Five hours.)

Military Geography. The Saxon land between the Elbe and Saale, and its influence upon the operations of war in North and South Germany. (Five hours.)

Criticism on the organization of the French Battalion. (At home in one day.)

Examination Essays, Staff School.—Military History, Tactics, and Administration.

1. In what respects did the earlier form of military art, strategetically and tactically, favour

Diffusive character of the teaching.

The extent of the knowledge required is seen both in the account of the "Organization of the Staff School" given in Appendix (R.), and in the list of the Lectures given below. Besides military subjects, it includes a very full course of Ancient and Modern History, in addition to the History of War (which last alone occupies seven hours weekly for the last year), a good deal of Logic and Philosophy of Art and Literature, and of Political Economy. Some of these lectures have probably been introduced from the School, having a double object, that of giving a diplomatic as well as a military education. This was the original idea of Frederick the Great, who, in all his plans of military teaching, laid a great stress on the general literature which he himself valued so highly. This diffusive study is a strong contrast to the principle of "little, but well," and to the constant practical exercises in the laboratories insisted on by the early Teachers of the Polytechnic School in France.

Plan of lectures.

The following is the plan of the lectures for the three years. Twenty lectures a week are the minimum:—

First year.

Course of First Year.

Obligatory.		For choice.	
Tactics	4 hours.	Universal History	4 hours.
Artillery	3 „	Universal Geography	3 „
Field Fortification	2 „	Physical Geography	4 „
Military and Political Administration and Economy	2 „		10 hours.
Mathematics, Pure and Mixed	6 „		
	17 hours.		

Total, 27 hours.

Second year.

Course of Second Year.

Obligatory.		For choice.	
Tactics	4 hours.	Universal History	4 hours.
Permanent Fortification	2 „	Mathematics	6 „
Special Geography and Geology	4 „	Logic	4 „
		Physics	4 „
		Lectures on Horses	2 „
	10 hours.		20 hours.

Total, 30 hours.

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defensive wars *generally*, and in particular assist Frederick II. in the Seven Years' War? (Two hours.)

2. The duties of the Staff in time of peace. (Two hours.)
3. Position of Landwehr Officers on and off duty. (Two hours.)
4. What is the value of the Cavalry formation *en échelon*, with particular reference to the Austrian mode? (Two hours.)
5. Is only one sort of Infantry necessary, or is Light Infantry essential? (Two hours.)
6. How may the mobilising of an Army be best expedited? (Five hours.)
7. Describe the different sorts of fieldworks particularly used in war. (Two hours.)
8. How is the Artillery of a Corps d'Armée to be used in the different emergencies of battle. (Five Hours.)

Literary and Scientific.

1. The geological characteristics of the country between the Carpathian Mountains and the Vistula on one side, and the Valdai Mountains and the Dnieper on the other. (Two hours.)
2. By what political conjunctures was the power and influence of England peculiarly advanced in the 18th century? (Five hours.)
3. On the magnetic effects of the electric stream. (Two hours.)
4. Characteristics of Greek literature, and its chief authors in the time of the Peloponnesian War. (Two hours.)

Third year.

Course of Third Year.

Obligatory.		For choice.	
History of War	7 hours.	General History of Literature	4 hours.
Staff Duty	3 „	Mathematics	6 „
Art of Sieges	2 „	Higher Geodesy	3 „
Military Jurisprudence	1 „	Chemistry	4 „
	13 hours.		17 hours.

Total, 30 hours.*

Surveying Staff Duty for three weeks.

It will be seen that the above course is entirely theoretical; no practical work (as in France) relieves the sedentary labour of ten hours daily for more than eight months of the year. But as soon as the first year's course is ended, all the Officers who are supposed to know drawing before coming to the School, are sent into the country for three weeks to practise military drawing and surveying: and those of the third year go through (also for the same period) a similar course of Staff Duty. These last are sent under the direction of the Officer who is Professor of Staff Duty at the School; each Student Officer gets his separate orders, and they meet and are told off every morning for their day's work, reconnoitring fortresses, surveying the frontiers between Austria and Prussia, &c. &c. During the remaining three summer months the students are sent in successive classes to those arms of the service which are not their own, and after the usual military exercises are completed they must bring back with them a certificate of proficiency from the Commanding Officer. This amount of time was spoken of as being too little.

Service with different Arms.

If we are surprised at not finding a greater amount of practical work included amongst the labours of the School, we must remember that it is chiefly postponed to a later period of the Officer's career, when the probability of his being required to use it on the Staff is greater. This is when he has gained his place in the Topographical Department, and is working there upon trial to test his fitness for the actual Staff. He is then employed during winter in working on the Theory of War, and during summer in military surveying and drawing.

* Lectures each week in the War School, Prussia :

War School.	First Year.	Second Year.	Third Year.
Mathematics, Pure	3	3	3
„ Mixed	3	3	3
H. Geodesy	—	—	3
Physical Geography	2	—	—
General „	4	—	—
Special „	—	4	—
Universal History	4	4	—
General History of Literature	—	—	4
Logic	—	4	—
Physics	—	4	—
Chemistry	—	—	4
Veterinary Art	—	2	—
Tactics	4	4	—
Artillery	3	—	—
Fortification, Field	2	—	—
„ Permanent	—	2	—
„ Sieges	—	—	2
Military Administration	2	—	—
History of War	—	—	7
Staff Duty	—	—	3
Military Law	—	—	1
French	6	6	6
Russian	4	4	4
Total	37	40	40

It would be impossible to enter on a detailed criticism either of these lectures or of the essays mentioned in the note above which evidently imply great study. We invite a comparison with the French plan, which we have given elsewhere, but the difference of age must be taken into account. The mathematical course at this school is,—

1st year. Plane and Spherical Trigonometry, Quadratic Equations, involving several unknown quantities, the Binomial Theorem, and the Elements of Analytical and Solid Geometry.

2nd year. Analytical Geometry and the Differential and Integral Calculus.

3rd year. Mechanics, Statics, Dynamics, Projectiles, and slight Applications.

Only the first year is obligatory.

Examinations, their frequency.

Such is the method and extent of the Officer's work at the Staff School; a few more words are needed on the character of his examinations, which here as everywhere else must greatly influence the character of the work.

There are no less than nine examinations during the three years, one for every three months, but the final one at the end of each year is the more important, as a sort of summing up of the year's work. In marking for this the merit of the essays done at home is taken into account. The result in each branch of work and on every examination is entered by the several Professors in a book kept at the Directory, and the pupils have a right to inspect the report of their own work. The net result of his own three years' work is also sent to the Officer after leaving the School through the authorities of his Regiment. The certificate of this contains the criticism on each branch of his work in detail.

Essays and notes of Lectures considered important.

The subjects given for essays* will show the nature of the chief examinations (*i.e.* those at the end of each year); four or five hours is the time generally allowed to a difficult subject, the examination stretching over a number of days, in proportion to the subjects taken up. The pupil may bring in his notes of lectures, on which extraordinary care is bestowed, and which must contain everything that can be said on the subject. Much value is said to be attached to the rapidity with which an essay is worked, as showing a quality valuable in an Officer. There is, as we have observed, no *vivâ voce* of any kind in this School. Some competition exists in the Staff School, (and it is almost the only Prussian school where we find it,) for the knowledge that only eight or ten out of the forty pupils can obtain the Topographical Department, and only two out of these eight or ten, the Staff, acts as a competitive stimulus. We must add, however, that although a minute account of the *positive* merits of the pupils is drawn up and sent to them at the end of their career, they have no means of ascertaining their *relative* positions; and this may always leave room for doubt, whether the places in the Topographical Department and on the Staff are strictly given by merit, or whether patronage does not here step in. Another ambiguity may be remarked in the fact that the relative importance of the subjects of study is not known. It may of course be surmised, that a knowledge of the Peloponnesian War is not marked so highly as that of the Seven Years' War; but any indefiniteness as to what is or what is not important, will generally lead to an attempt to know something *of all* the subjects mentioned, and it would undoubtedly be better to affix its definite value to every subject. It would prevent what seem to us valid objections to the present system of the Staff School, the attempt to crowd in too many subjects, instead of mastering thoroughly a few.

Competition limited by the final position of the Student being unknown.

Final examination.

The final examination having been completed in June, the student goes through the three weeks of Staff duty we have described, and finishes his last three summer months in that branch of the Army in which he has not yet served. He then returns to his Regiment, where he receives the certificate of his three years' work. But no list is published of the order of merit in which the Officers stand. If the certificate is satisfactory, he forwards it to the Chief of the Prussian Staff, with a request to be employed in the Topographical Department of the Staff. If this is granted, he receives an order to join it in about two years, *i. e.* about nine or ten years after first entering the service.

Some Officers employed in the Topographical Department.

About eight Officers are yearly sent to the Topographical Department, and serve there for two or three years, surveying and drawing in summer, working at military science in the winter. The correction of the Topographical Map of Prussia is in their hands. Finally, two out of these are selected for the Staff; the remainder return to their Regiments, to become Adjutants or to teach in the Division Schools.

The most immediate advantage of being in the Staff Corps is promotion to a Captaincy at any age, which, considering the extreme slowness of promotion in Prussia, may be termed an early one. This is generally gained within two or three years after joining the Corps, *i. e.* at thirty-three or thirty-four. In other Corps hardly any one has a chance of becoming Captain till after forty.

System followed in the Staff Corps.

We may add, that the number of Officers in the Topographical Department is about forty, on the Staff itself sixty-four. No one belonging to the Staff is below the rank of Captain, or above that of Colonel. Every General of Division has one Officer of the Staff attached to him, and two Adjutants, the first nominated by the Chief of the Staff, the two last by the King, and these two belong rather to the Officer than to the General. They are not removable with

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* See Note, p. 115.

him. The Adjutants are not Officers of the Staff, though they are often chosen from amongst those who have been at the Staff School. They are nominated by the King upon reports sent into him by the Generals of Division, and the appointment is not considered a great prize, as it implies neither extra pay, promotion, nor permanency; the Adjutants are promoted in the usual course, and then, upon promotion, return to their Regiments. The Adjutants of Battalions and Regiments are appointed, like our own, by the Officers commanding. The name of Aide-de-camp does not exist in the Prussian service, but that of Adjutant is used in its place.

SECTION IV.—OTHER MILITARY SCHOOLS.

Some account has now been supplied of the four principal military educational institutions of Prussia. Of the others we visited two, the Orphan House and the Non-commissioned Officers School or School Division, at Potsdam.

1. *The Military Orphan Houses* (Militair-Waisenhaüser) *at Annaburg, Potsdam, and Pretzsch.*

Orphan House at Potsdam.

The Orphan House at Potsdam was found to contain about 800 pupils, of whom 200 were mere children under the charge of women; 520 were in the senior department; 36, including some still older, were in the Music Class, and would go into the Regimental Bands; and about 20 formed a separate Military Class, and would most likely enter the Artillery.

The school-rooms, the dormitories, the dining-room, and the kitchen, all appeared to indicate careful and cleanly supervision and attendance. The buildings form a large pile, and stand in the town of Potsdam.

Girls' Orphan House at Pretzsch; Boys' at Annaburg.

There is an affiliated establishment for girls at Pretzsch. The School at Annaburg is distinct, and is also for boys.

Object of the Orphan Houses.

The institutions in general are intended for the reception of the children of Soldiers and Non-commissioned Officers, and admit not orphans only, but those also whose parents are too poor to provide for them. They are brought up for ordinary trades, and are not intended for military any more than for civil occupations. At one time the *School-division* was recruited largely from the Orphan Houses, but this is said no longer to be the case.

Religious Arrangements

The School at Annaburg, and the subsidiary Girls' School at Pretzsch, are both Protestant in character; no religious teaching is supplied for Roman Catholics. Roman Catholic boys are all sent to Potsdam, and Roman Catholic girls are provided for in ordinary schools and in private families, and payment made on their behalf out of the funds of the institution.

2. *The School Division* (Schul-abtheilung) *or Non-commissioned Officers' School.*

Object of the Institution.

This is an institution for training up young men for the duties of Non-commissioned, or as they are styled in German, *Under* Officers. The rules of the Prussian military system, which require only three years absolute service in the Standing Army in time of peace, evidently entail a great practical difficulty in this respect. The soldiers, as a rule, prefer to quit the service at the end of their three years' time, and require great inducements to persuade them to remain. As one inducement, the State has declared that twelve years' service gives a Non-commissioned Officer a formal claim to civil employment; as, for example, on the railways or in the custom-houses. Their pay also as Non-commissioned Officers goes on increasing according to the length of their service; and it was stated to be the usual practice not to advance soldiers to be Non-commissioned Officers until they had signed an undertaking to serve for a longer period than could be exacted of them otherwise.

A further means of supplying the want has been sought, and appears to have been found in the School Division. The circumstances of its origin have placed this establishment in immediate connexion with the Corps of Guards, to which, in a military sense, they belong, at whose head quarters, the town of Potsdam, their buildings are situated, and whose garrison duty in the town they occasionally undertake.

Mode of Admission.

At its first commencement the pupils chiefly came in drafts from the Military Orphan Houses. But the applications from the country in general have been so numerous that this practice has been, it is said, abandoned, and a higher class of admissions has been attempted. The Commander of the Battalion of *Landwehr* for the Circle (*Kreis*) receives all applications in that Circle; he sees that the candidate is examined on the spot, in reading, writing, and cyphering; and forwards the name, height, age, and other particulars (the *Nationale*) to the authorities. The decision is said to be mostly made by the candidate's height, and his medical certificate, and to be rather a difficult matter. Only one-third of the applications are successful. A new boy had just presented himself with his father at the time of our visit; both son and father were well dressed, and

apparently belonged to the middle rather than the lower classes. There seem every reason to be satisfied with the amount of acceptance with the country which the School had begun to receive.

Age of Admission. Engagement to serve.

The age of admission is from 17 to 20, and the youth on entering the School takes a military engagement to give two years of service in the Standing Army for each year of his maintenance at the School, in addition of course to those three years of military service to which every Prussian is bound, but with the privilege of counting as military service the period spent at the School.

The usual School course is one of three years, and his engagement is thus for a term of nine years; that is, deducting three spent at the School, six years' time with the troops.

Numbers.

The School Division is 496 strong; there are four companies of 124 men. The whole body is commanded by a Captain, or Major, who has an Adjutant. To each Company are attached four Officers and fourteen Non-commissioned Officers; the latter teach in the two first years, the former in the third.

Studies.

The School course begins on the 1st of October; the afternoons of three days in each week are employed in ordinary School instruction, but the remainder of their time in winter and their whole time in summer is devoted to military training. The School instruction is not carried beyond reading, writing, and arithmetic up to the rule of three; geography, drawing skeleton maps, and copying, and learning the significance of military representations of ground. Some very respectable specimens of their skill in copying maps were produced; it appeared to be a favourite exercise.

Entrance into the Army.

About 150 are admitted yearly, an extra number being taken to supply possible vacancies; about 130 yearly are drafted into the Army, six usually as *Under* Officers at once, forty at least with certificates of being qualified to receive the grade in a short time; and the whole number who go out have generally obtained their appointment before twelve months are completed. The highest number that may go out at once as Under (or Non-commissioned) Officers is twelve; three for each Company. Many, however, have latterly, it is said, become so within six weeks after their leaving.

Where the young men are strong and full-grown, they are allowed to join the Army at the end of two years; their whole service (two years for each at the School) being therefore reduced to six years.

Young men, on the other hand, who show no disposition or likelihood to turn out good *Under* Officers, are sent off to complete the usual time as privates.

Number of Under Officers taken from the School Division.

The proportion of Non-commissioned Officers in the Standing Army who are taken from the School Division was not easy to ascertain. It differs extremely in different Regiments. In one, it was stated that out of the ordinary complement of 180, fifty came from hence. On the other hand, it was asserted that the general proportion was not more than one in forty. A certain number have obtained commissions; but no prospect of such promotion appears to be held out, and any tendency to carry forward the studies with a view to it is discouraged and checked.

Buildings. Dining and Exercise Rooms.

The buildings, in the outskirts of Potsdam, are large, new, and handsome, forming three sides of a spacious court or imperfect quadrangle. The dining-rooms are used also as exercise-rooms, and it was made a point to let us see a portion of the pupils go through their gymnastics and exercises; and more particularly their sword and bayonet exercise. Twenty or thirty young men, very healthy and strong-looking, went through the latter exercise in two lines; after which came a single combat with the bayonet, all under the direction of an Officer.

Bed-rooms.

The sleeping-rooms are fairly large, and well ventilated, on the same floor. Twelve slept in each. During the day the wooden bedsteads are placed one above another. It was said that iron bedsteads are being generally introduced. Each young soldier is provided with a small cupboard above his bed. The Non-commissioned Officers had horsehair, the young men themselves straw paillasses. There was a stove in the room, but it was said not to be used.

School-rooms.

The school-rooms are in the upper floor. The skeleton maps already referred to were here produced; one, of the two hemispheres, others illustrating Prussian history, showing the original size of the Prussian territory, its extent and condition under Frederick the Great, the whole course of its gradual extension, &c., very fairly drawn, and creditable to the young men.

The Time very long.

The time devoted to the training which is given in the School Division

appears long. What is now done in three years might as well be done in half that time. The object, however, is secured of retaining the service of the men during a lengthened period in the Standing Army.

3. *Other Schools.*

The Regimental Schools are chiefly intended to train up Non-commissioned Officers. This is more particularly the case in the Artillery, which does not obtain its *Under* Officers from the School Division at Potsdam.

The Noble-School at Liegnitz is merely an endowed school, founded by the Emperor Joseph I. while Silesia was yet an Austrian dependency, and specially intended for young men of good birth in that country. There are some military foundations in the School for the sons of Officers of good birth; and the two military men who take part in the instruction are paid by the State, on the same footing as Officers employed in the State Military Schools.

SECTION V.—1. HISTORICAL OUTLINE OF MILITARY EDUCATION IN PRUSSIA, DOWN TO 1815.*

Peculiar features of Military education in Prussia.

The Prussian system of Military Education stands in close connexion with the general education of the country, just as the Prussian Military organization is the peculiar creation of that country's history. And the greatest improvements in the Army and in its scientific teaching have been made at those remarkable periods when we should most naturally have looked for them—the time of Frederick the Great and the Liberation War of 1813–1814.

The leading principles of Prussian Military Education have been elsewhere stated. They consist, FIRST, in requiring from every Officer in the Army proof of a fair *general* education before his entrance, and of a fair *military* education afterwards. SECONDLY, they encourage a higher military education in a senior school, which has almost exclusively the privilege of supplying the Staff.

In this requirement of a fair education, both general and military, *universally* from its Officers, Prussia stands alone among the great military nations of Europe, and this honourable distinction is in a great measure the result of the diffused system of education throughout the country, and of the plan adopted by Stein and Scharnhorst, to make the Officers the leaders of the army both in education and in military science.

Early Schools in Germany.

The military schools of Germany may be said to have begun with the Reformation wars. Some such were founded by Maurice of Saxony, the great political and military genius of Germany in that century; the example was soon imitated in Baden, Silesia, and Brunswick,† and a curious Sketch of Military Education, by the hand of Duke Albert of Brandenburg, has been lately published from the Berlin archives, in which theology and mathematics hold the two most important places.

The School at Colberg under the Great Elector and the two first Kings.

The first school of any real importance was founded in Colberg by the Great Elector Frederick William, in 1653. This had considerable success, and both his successors, King Frederick and Frederick William I., improved it greatly, and finally transferred it to Berlin. It was the time (about 1705, 1706) of the great advance in military engineering under Vauban and Coehorn, and a school for engineering was founded, in which some of their pupils had a great share. The first Prussian trigonometrical survey also dates as early as 1702‡ Our own was not commenced till 1784. It may indeed be said that the scientific arms began to take a more favourable place in the Prussian Army about this time. They have held, and even still hold in some respects, a less distinguished position in Germany than in France, England, or Sardinia; and the first instance of an artilleryman being made a General was in the reign of Frederick William I.§

Measures adopted by Frederick the Great.

On Frederick the Great's accession he found several Military Schools in existence. These had been chiefly founded by his eccentric father, who had a passion for Cadet Houses and Cadets, and their object is said to have been to supply an education to the nobility, who at that time (and indeed much more recently) were very ill taught in Germany. After Frederick's first wars, his own attention was much occupied by the need of a better military education, and he continued to work at the subject very zealously till his death. His example on this point, as that of a great military authority, is most instructive, since his object was at first only to educate Cadets *before* their entrance to the Army, but was afterwards extended to completing the education of Officers already on active service. His views on the last point were carried out by Scharnhorst. They were the germ of the present Prussian military education.

Foundation of the *Ritter Academie* after the close of the Seven Years' War.

It is curious to observe that the Austrian Succession War and the Seven Years' War, the first great wars since Louis XIV., and which broke the Thirty Years' Peace of the 18th century, are periods at which scientific military education made a great step in Europe. A Treatise of Marshal Count

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* The chief authority for this paper is a very detailed account of the Staff School (*Kriegs-Schule*) by Friedländer, pp. 1-360. We may also refer to official documents printed elsewhere in our Report.

† Friedländer's "Kriegs-Schule," p. 3.

‡ Friedländer's "Kriegs-Schule," p. 21.

§ "Kriegs-Schule," p. 29.

Beausobre's on the subject first showed the existing want; it is entitled "Utilité "d'une Ecole et d'une Académie Militaire, avec des Notes, ou l'on traite des "Ecoles Militaires de l'Antiquité." It attracted great attention on its appearance*. Most of the Military Academies properly so called date from about this time. The earliest warrant for Woolwich† dates in 1741. The Theresianum of Maria Theresa was begun at Vienna about 1748. The first French School was the celebrated Engineer School of Mezières founded in 1749. This was soon followed by the old Military School of Paris in 1751, and by the School for Artillery at La Fère in 1756. We have elsewhere mentioned other French Military Schools of the same period. Frederick's own *Ritter-Academie* dates from 1764.

His own statement of his object.

Frederick began this institution with his usual energy, immediately on the close of the Seven Years' War. "My fire is quenched," he writes, "and I am "now only busied in improving the practice of my men. . . . . The position of "the common Soldier may be left as it was before the war began, but the "position of the Officers is a point to which I am devoting my utmost care. In "order in future to quicken their attention whilst on service, and to form their "judgment, I have ordered them to receive instruction in the art of war, and "they will be obliged to give reasons for all they do. Such a plan, as you "will see, my dear friend, will not answer with every one; still out of the whole "body we shall certainly form some Men and Officers, who will not merely have "their patent as Generals to show, (*die nicht blos patentirte Generale vorstellen*) "but some capacity for the office as well"‡ He had, in fact, seen with great admiration the improved Military School recently founded by Maria Theresa; and as it is best on such points to let this great authority be heard for himself, we shall quote his own words:—

The School was an imitation of that of Maria Theresa.

"In order to neglect nothing bearing on the state of the Army, the Empress "founded near Vienna (at Wiener Neustadt) a college where young nobles "were instructed in the whole art of war. She drew to it distinguished Profes-"sors of Geometry, Fortification, Geography, and History, who formed there "able pupils, and made it a complete nursery for the Army. By means of her "care, the military service attained in that country a degree of perfection which "it had never reached under the Emperors of the House of Austria; and a "woman thus carried out designs worthy of a great man."

His letters show that he contemplated an improved school, and he says to D'Alembert: "I send you the Rules of my Academy. As the plan is new, "I beg you to give me your honest opinion of it." Accordingly, the Academy was founded. We will describe it in his own words:—

Intended for Cadets before entering the Army.

"An Academy was founded at the same time, in which were placed those of "the Cadets who showed most genius. The King himself drew up the rules "for its form, and gave it a plan of instruction, which stated the objects of the "studies of the pupils, and of the education they were to receive. Professors "were chosen from the ablest men who could be found in Europe, and fifteen "young gentlemen were educated under the eyes of five instructors. Their "whole education tended to form their judgment. The Academy was suc-"cessful, and supplied able pupils, who received appointments in the Army."§

Opening of the Academy in 1765.

This School, which was opened in 1765, was Frederick's only foundation of the kind; he was occupied with it incessantly. The plan of its studies was drawn up by his own hand, and we have many of his letters of encouragement to its pupils or professors. Whether he is writing to Voltaire, Condorcet, or "My Lord Marischal" Keith, he constantly shows both his well-known attention to the economy of his new school, and a paternal interest in his young Cadets and their Teachers.‖

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* Friedländer, p. 39.

† It appears, however, that Woolwich had actually existed as a Royal Military Academy since 1719; but there are no documents respecting it. See Records of the Royal Military Academy by Col. F. Eardley Wilmot, p. 1.

‡ Friedländer, p. 41. Letter to Fouqué.

§ "Histoire de mon Temps."—*Œuvres*, vi. p. 99.

‖ He gives himself, in his forcible style, the reasons for his attention to early military schools. He had found his young nobility excessively averse to such education. "They shrink from the "Army," he said, "because in this country it is a real training for the character. Nothing is "passed over in a young Officer; he is obliged to maintain a prudent, regular, and sensible "conduct. . . . . This is precisely what they dislike, and one still hears the absurd and insolent "expression, 'If my boy will not work, he will do none the worse for a soldier.' Yes, he may do "for a mere man-at-arms (*fantassin*), but not for an Officer fit to be advanced to the highest "commands, the only end of a good soldier's life, and which requires a really extensive knowledge." —*Œuvres*, ix 117, 120.

Its high character.

Accordingly, both in professors and pupils,* the new Institution soon gained an European character. Out of its twenty first directors, no less than ten were distinguished foreigners; and it is a matter of interest to an Englishman to find a letter from General Jarry, so well known at the foundation of Sandhurst, in which he mentions having been appointed governor of the *Kriegs-Schule* by Frederick;—"Immédiatement après la guerre de sept ans, il plut au roi de me "confier le commandement de l'Ecole de Guerre qu'il venoit de créer auprès de "lui." Nor is it less interesting to find that one of the best teachers at Berlin was D'Antoni,† a distinguished soldier from the Turin Institution and the Artillery School at Alessandria—schools which were still the representatives of the military science of the great Italian generals, of the Duke of Parma, of Spinola, and Montecuculi. We shall have occasion, in mentioning the Schools of Turin, to speak of the attention shown in Piedmont to the Artillery, and the great place which that main arm of the service has ever held in its Army.

Frederick did not found Senior Schools:

but greatly encouraged study amongst his Officers.

This Institution was still, as it would appear, upon the old principle of Juvenile Army Schools, nor does Frederick seem to have set on foot any school for Officers after entering the service. But he evidently felt strongly the need of improving his Staff Officers and of raising the science of his Artillery and Engineers. To use again his own words in the Memoires de 1763–1775‡—"L'armée avoit fait bien des campagnes, mais souvent le quartier-général avoit "manqué de bons maréchaux de logis. Le roi voulut former ce corps, et "choisit douze officiers qui avoient déjà quelque teinture de génie pour les "dresser lui même." Thus we find him referring to the French Engineer School at Meziéres, whose high character we have elsewhere mentioned; and he endeavoured to raise the intelligence and education of his Officers. It may, however, be suspected that the spirit of the "Potsdamer Côterie," as it was called, became gradually, and particularly after Frederick's death, too literary and speculative to suit the rough work of war;§ and it may, perhaps, be thought that some defect of this kind is still traceable in the excessive amount of teaching and the abstract nature of some of the subjects taught in the Staff School at Berlin.

Speculative tendencies of his School.

Views of Scharnhorst.

Such seems to have been the opinion of Scharnhorst, the virtual author of the present system of army education, and whom the Prussians still regard as their first authority on that subject. "Instruction is given," he says, "at the "Military School in all literature, in philosophy, and in many various "sciences. Frederick seems to have wished to lay in it the foundation of the "education at once of an Officer and of a learned man. Few men, however, are "able to excel at once in various branches of human knowledge, and the surest "means to do so in *one* is not to attempt it in *many*."—(Military Journal, ii. 40).

We have referred to Frederick and his School rather to show the interest he felt in Military Education, than because his institution was very important. Military Education was still very imperfect, and it completely languished in Prussia till Scharnhorst established it on its present footing.

Scharnhorst's Reforms, commencing after the battle of Jena.

Scharnhorst was himself an Hanoverian, but entered the Prussian service, and had seen by experience the defects of their system in the campaigns of 1792, 1793, and 1805. He had long devoted especial attention to Military Education and to all the scientific part of his profession. Along with Blucher and Gneisenau, he was considered one of the first Generals of the Army, and, on the exhaustion of Prussia after Jena, he was selected to remodel its whole system. He did not live to complete his work, having been killed early in 1812; but his statue near the bridge at Berlin, remarkable for its noble and thoughtful expression, records the gratitude of Prussia to its greatest scientific soldier.

Scharnhorst exercised so great an influence at a critical moment, and this influence has been so permanent, that we may be excused for quoting the description given of his work and its objects by one of our own historians.‖

"The perfection of the French military organization," says Mr. Alison, "appeared to him in painful contrast beside the numerous defects of that over

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* *See* the List in Friedländer, Appendix, 1, 327.

† Friedländer, pp. 33 and 76. ‡ *Œuvres*, vi. 98, from Friedländer.

§ Von Göthe's Campaign in France; Farie's translation, p. 25.

‖ History of Europe, vol. vi. 452., 8vo. edition. Varnhagen von Ense, the Prussian historian of this period, says the same.—Life of Prince Blucher, p. 120, and Denkwürdigkeiten.

" which he presided. . . . . Boldly applying to the military department the " admirable principles by which Stein had secured the affections of the burgher " classes, he threw open to the whole of the citizens the higher grades of the " Army, from which they had been hitherto excluded. . . . . And every depart- " ment of the public service underwent his searching eye."

Commission of 1807.

The work began with the Commission of 1807, of which both Stein and Scharnhorst were members. And the Regulation of 1808 laid down the principle broadly, that the only claim to an Officer's commission must be, "in time of peace, knowledge and education; in war, courage and conduct."*

Suppression of the Junior Schools and creation of a Senior and Junior Department in the War Schools.

On these principles, during the next three years, Scharnhorst laid the foundations of the present education. He abolished most of the existing juvenile schools, with the exception only of the Cadet Houses, intended almost solely for the sons of Officers. He changed the previous War School into a sort of School *d'Elite*, consisting of a senior and junior department, in which the younger soldiers of all arms were to be imbued with such knowledge as might give them a scientific interest in their profession, and in which Senior Officers (also of all arms) were to have a higher course of a similar nature, success in which was to form a recommendation for employment on the Staff. He began the plan of the Division Schools, where all candidates for commissions, but not yet Officers, might conduct their military studies along with the practice of their profession. Its idea was to make some military study *necessary*, and successful study *honourable*, in the Army. Finally, he began the present system of careful examination on entering the Army.

System of entrance and examination.

Of the Division Schools we have elsewhere spoken fully, and the examination at entrance into the Army forms one of the most important features in the Prussian system.† The third point in Scharnhorst's scheme, his principal school, appears defective, owing to its attempt to combine in one institution a senior and a junior department of very different ages, and to give a complete Military Education to the Officers of all arms in common. His own words lead us to believe that this last regulation was caused partly by a wish to terminate jealousies between different arms of the profession, and partly by a desire that each branch of the service should know something of the tactics of the others, with which it is obliged to act. The plan, however, was overdone, and in this respect failed; and within a few years the junior department was given up, and the Artillery and Engineers were placed together in their separate Academy.

Report of the Mixed Commission under General Lützow.

For further details on this point, and for the subsequent history of Prussian Military Education, we must refer to Colonel von Holleben's account of the Division Schools. The principles of military study are laid down in a very interesting manner in the Report of a mixed commission of military and scientific men, presided over by General Lützow. We cannot think it out of place to reproduce some of their remarks on the subjects and the method of their teaching.

Subjects of Study. Mathematics.

With respect to the subjects taught, the chief stress was laid upon mathematics: " Instruction in pure mathematics in the Military Academy," says the program, " particularly in the lower classes, must be considered one most " important branch of teaching; not merely because the chief points in " military science are founded on mathematical principles, but still more " because a profound study of mathematics accustoms the head to clearness, " accuracy, and method in thinking."

Geography, History, and Statistics.

Great attention is to be paid to geography. " Geography, history, and " statistics are the sciences, by the study of which a young man comes into " connexion with the world before he knows it practically. In learning these, " a scene is opened to the youthful mind, by which the germ of fancy and of " moral feeling is ripened; the ideas of civil life are opened, and the boy begins " to pass from the limits of his own childish experience into the large domain of " the real world. The importance of this subject in a really good education, " makes it essential that the pupil should obtain a firm hold of it in his youth. " And to give him this, we must not aim at teaching *many* things, so much as " at imparting a clear view of some important time or point, which will give a

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* Cabinet Order of September 9, 1808; quoted in Friedländer, pp. 225.

† These examinations were not begun in Scharnhorst's time, as it was a period of war; but they came into action on the establishment of peace in 1815.

" practical insight into history. Let the teacher select some such period—one " which will give his pupil a foundation in historical science."

So again, as to physical and historical geography. " It is here particularly " that whilst we give the soldier a sufficient knowledge of preparatory science, " we should point its application to the business of war. Without war, to gain " some knowledge of war beforehand, to accustom the mind to throw itself (as " it were) into the most perplexed circumstances of war, and to see what " principles are to be applied to them, is certainly a great object in military " science. Military geography helps us to do this; first, because without it. " the operations and conduct of a war are not intelligible; secondly, because " the thorough knowledge of a country, both in its inhabitants and its physical " geography, helps us to conceive the course which any future war will take, " and the best mode of conducting it. The first is the more elementary—the " latter the higher, practical, and strategical branch of the science. And this " last requires so much thought and knowledge, as to make it undesirable to " teach it in an early school. It should form the employment of a Staff School. " But detailed suggestions are given for a course of the simpler kind of " military geography."

With regard to languages, German and French are the only two, as it seems to us wisely, attempted. Languages.

The Commission itself, in a letter addressed to the King, draws attention to the principles guiding its recommendations.

" Its starting point has been the principle that we must endeavour to call " out ability and educate the mind, rather than to fill it with a mass of various " knowledge. No young man can carry off from any school a knowledge of " all the facts and principles he is to meet with in life; but he who by his " studies has gained the habit of exertion and of helping himself, is far better " armed than one who has merely a great mass of information fixed in his " memory. It is true that as a youth advances towards the age of manhood " and of entering on his profession, his mind already cultivated by study, ought " to begin to amass materials which he may work upon as a citizen and a public " servant, and consequently in the higher class of our institution we lay great " stress on special professional teaching. But we must never lose sight of the " fact, that the object of all information and teaching is but to strengthen our " powers of thought and judgment, and that all the instruction given should " have this end in view." Recommendations, to aim at forming ability rather than at giving a mass information.

Finally some remarks are made on an important point in the system:

" As far as the official arrangement and direction of the Institution is con- " cerned, the Commission thinks it desirable to separate the Direction of Studies " from the Military Direction. Such direction, we think, should be a permanent " office, independent of the Military Director of the Institution; for the " union of two scientific Officers and two scholars of practical experience in " education seems to us best adapted to superintend the scientific requirements " both of teachers and pupils, whilst on the other hand the régime of discipline " and arrangements of the establishment should be left to the Military " Director. The relations of these separate and independent authorities are " fixed in the plan . . . . ." Separation of the Direction of Studies from the Military Direction.

The following are the arrangements proposed on this subject:—

" The Scientific Direction or Direction of Studies is composed (1) of two " scientific Officers, one a Staff Officer, the other an Officer of inferior rank in " the Army; (2,) of two men of science or learning in Berlin, of practical ex- " perience in education, and of reputation for knowledge and character. The " Staff Officer is its President. Board constituting the Direction of Studies.

" In order to maintain unity in the teaching, and to adjust the subjects " taught, the Direction of Studies is bound to hold conferences with the " teachers.

" At the beginning of each course of study the Direction of Studies revises " the plan of instruction, and submits it, with any alterations required, to the " superior authorities.

" The Direction of Studies subjects to some examination the Teachers to be " appointed, and submits the proposals touching their appointment to the superior " authorities. It supplies the Teachers with their instructions, consults with " them on the choice of text-books, &c.

"It examines also the pupils to be received into the higher class as to their "possession of the requisite acquirements for pursuing its studies with advan- "tage. It transmits its judgment on this point to the higher authorities."

General results.

Such are the principles of teaching drawn up by Lützow's commission, in accordance with Scharnhorst's plan of Military Education. Some points in the plan have been since changed with advantage, such (*e.g.*) as that to which we have alluded, the combination in one school of two classes of Officers, whose ages, acquirements, and objects of teaching must have been so very different. In fact the Division Schools, now beginning, supplied all the necessary instruction for junior Officers.

The result of Scharnhorst's plan, in its complete form, was the systematic arrangement of the education of the Prussian Army under the three following heads:—

1. The Cadet Institutions of Berlin and Stolpe (for both general and special education before entering the Army).
2. Three schools for young Officers who have not yet received their full commission at Berlin, Königsberg, and Breslau.
3. The *Kriegs-Schule* (the Staff School) for Officers at Berlin.

We should add, what appears from our general account, that it was afterwards found best to separate the Artillery and Engineers from the *Kriegs-Schule*. A special school was erected for them, *Unter den Linden*, in Berlin, in 1822.

Subsequent changes, see Col. von Holleben's account, page 131.

Since this date the principal change in the military education took place in 1846. Its tendency was to raise what we may call the Entrance Examination into the Army, and to make it more completely correspond with the general teaching of the superior schools of Prussia.

For details as to these changes we may refer to the valuable account with which we have been favoured, since these pages were written, by the Adjutant of the General Inspector, Colonel von Holleben. The latter part of his account, on the Division Schools, forms the natural continuation of this paper.

2.—PAPER COMMUNICATED BY COLONEL VON HOLLEBEN.

I.—*General View of the System of Military Education in Prussia.*

Military Examination and Education under the control of the General Inspector of Military Education,

The whole Department of Military Examinations and Education is under the control of the General Inspection of the Department of Military Education, the expenses of which stand in the estimates as follows:—

	Dollars.	
For the General Inspector - -	5,200	Besides allowances for extra services and rations.
For the Adjutant - - - -	1,900	
For the Secretary - - - -	600	
For Messengers - - - -	100	
or Office Expenses - - -	250	And official apartments in the Royal Building.
	8,050	

who reports direct to the King, and lays his proposals on financial matters before the Minister of War.

The General Inspector reports directly to His Majesty the King in all matters relating to instruction and examinations, and lays his proposals on matters of administration before the Minister of War, who communicates the requisite instructions to the Boards (*Corps-intendanturen*) charged with the financial control of the various Schools.

Supreme Board of Military Studies assists the General Inspector.

The General Inspector is assisted by a Scientific Board, called the Supreme Board of Military Studies, acting with him as a council, and composed of Field Officers of the General Staff and of the Special Arms, Consultative Assessors (*Vortragenden Räthen*) of the Minister of Worship, and individuals selected from the general body of learned men (Professors).

From the members of this Board the Boards of Studies attached to the various educational institutions are appointed, and receive for these functions, in addition to their official salaries, honoraria varying from 100 to 300 dollars per annum.

The estimates charge, besides office expenses, under the head of honoraria or augmentations,—

	Dollars.
For the Board of Studies attached to the Division Schools (4 Field Officers and 1 Member of the body of learned men) - - - - - - -	800
For that of the War School (2 Field Officers and 2 Civilians)	1,200
For that of the Cadet Corps (at present 1 Field Officer and 1 Member of the body of learned men) -	500
Total -	2,500

The Directors of the Schools are Members of the Supreme Board of Military Studies.

The Director of the War School, the Director of the Supreme Board of Military Examinations, the Director of the Artillery and Engineer School, and the Commander of the Cadet Corps, are also members of the Supreme Board of Military Studies.

By the help of these Scientific Boards, the General Inspector is placed in a position to subject the system of instruction, both in general and in all its parts, to the continual observation and control of specially qualified persons, and to direct the various Military Schools in such a manner as to secure their proper co-operation with each other, and to keep them in harmony with the higher Civil Schools of the State.

It is to this organization of the higher military authorities that Prussia owes in a measure the unceasing progress of her scientific military Institutions since 1808.

To give an idea of the functions and operations of these Boards, the regulations recently framed for their procedure are given in Supplementary Papers A, B, C, D.

The following Schools are subject to the General Inspector:—

1. The General War School at Berlin.

Staff School.

The object of this School is to educate the more capable Officers of all arms, after they have practically approved themselves in an actual service of at least three years, for places on the staff and for all appointments which require a higher scientific Military Education.

The course is of three years. The Officers while attending the School have leave of absence from their corps, from which they continue to draw their pay, and to which they remain in other respects attached.

The War School is allowed in the estimates an additional sum of 22,000 dollars, and the institution is amply furnished with rooms and apparatus of all kinds.

2. The United Artillery and Engineers School at Berlin,

United Artillery and Engineers School.

Intended for the education of Swordknot Ensigns (*Portepée-fähnriche*) in the Artillery and Engineers, who attend it for three years, and undergo at the end of the first year the general examination for the rank of Officer in all arms, and at the end of the two other years, examinations in the sciences peculiarly connected with the special arms.

The school is under the supervision of the General Inspectors of the Artillery and Engineers.

The estimate for this school is about 17,000 dollars, exclusive of the charge for buildings and repairs.

3. The Cadet Corps,

Cadet Corps, containing 720 free places.

Consisting of the Central Institution at Berlin, and of the four Provincial Cadet Houses at Potsdam, Culm, Wahlstatt, and Bensberg, with 720 Royal or free Cadets, and about 400 Pensioners or paying pupils. It is intended to be a seminary of Officers for the army, and at the same time an educational establishment; supplying 720 free places to the sons of meritorious Officers at a small payment, and offering in its Pensioner places to the sons of citizens of all classes, the means of preparing themselves for other professions as well as that of the army. According to the plan of study followed at present, the Cadet Corps may be said to constitute a Gymnasium with a military organization.

The estimate for the Cadet House at Berlin is	-	106,000	dollars.
,, ,, that at Potsdam	-	44,000	,,
,, ,, ,, Culm	-	36,000	,,
,, ,, ,, Wahlstatt	-	42,000	,,
,, ,, ,, Bensberg	-	44,000	,,
Total	-	272,000	

Of which sum, however, about 100,000 dollars are produced by the payments and part payments of the pupils, so that the revenues of the State have to contribute about 175,000 dollars, exclusive of the charge of the buildings and the original outlay for their first establishment.

4. The nine Division Schools—

Nine Division Schools.

At Potsdam	-	for the Guards.
Königsberg	-	,, 1st army corps.
Stettin	-	,, 2nd ,,
Frankfort	-	,, 3rd ,,
Erfurt	-	,, 4th ,,
Glogau	-	,, 5th ,,
Neisse	-	,, 6th ,,
Münster	-	,, 7th ,,
Trèves	-	,, 8th ,,

In these Schools Swordknot-Ensigns (*Portepée-fähnriche*) receive the professional instruction required for admission as Officers into the Infantry and Cavalry.

The organization and plan of study of these Division schools is contained in Supplement E.

The estimates charge for each School only about 1,900 dollars, that is—

For the personal establishment	-	1,200
,, material	-	700

And in addition to this 1,600 dollars for the libraries of those divisions to which no school is attached.

In regard to the cost, however, it must be remembered that the Director, the Teachers, the Inspecting Officers, as well as the scholars, are only detached

from their corps, and still draw their pay and other allowances from it, and that the Schools are conducted in Royal buildings. So that it is only extra pay that the teachers and examiners receive out of that sum of 1,900 dollars which has also to cover all accessary expenses.

The estimate for the complete endowment of a Military School of from sixty to eighty students, according to these statements, would include the following items:—

	Dollars.	
For a Field Officer as Director a salary of	1,800	besides allowances for extra services.
For four Captains as Teachers, at from 600 to 1200 - - - -	4,000	
For six Lieutenants for Supervision and Gymnastic Instruction - -	1,600	
For the inferior Staff, Office expenses, &c. &c. - - - - -	500	
Say	7,900	
Besides for the material establishment, about - - - - - -	1,100	

Which calculation assumes that the rooms and students' barracks are found for us, and maintained at the charge of the Garrison Department.

Examination for Ensigncy and Officers' Commission placed under the General Inspector.

The Boards of Examination for an Officer's commission and a Swordknot Ensigncy, which are independent of the Schools, and were formerly presided over by a different head are now placed under the General Inspector. The latter is thus in a position to secure that the scope and manner of the examinations shall exercise a salutary influence on education, and that their standard shall be adjusted to the capacities of the Schools.

These Boards consist of the Supreme Board of Military Examinations at Berlin, and the nine Boards of Swordknot Ensign (*Portepee-fähnrich*) Examinations, one for each Army Corps.

The range of the examinations, the organization and procedure of the Boards are given in Supplement F.

The estimates charge to the Supreme Military Examinations Board:—

	Dollars.	
For the Director - -	3,000,	besides allowances and rations.
For the Inspectors (*Inspicienten*) of the candidates and the Secretary - - -	1,200,	besides residence.
For Office expenses - -	300	
For the Registrar (*Registrator*)	300	
For the Honoraria of Examiners, whether Professors or Officers	900	
Total -	5,700	

The rooms required, including the lodgings of the candidates, are in a Royal building.

The Boards of Examination for the Swordknot are under the Directors of the Division Schools, and the Examiners, Officers and Civilians, receive a remuneration for their labour besides their official salaries.

II. *Historical View of the Origin and Transformations of the Military Schools, now called Division Schools.*

The Division Schools have gone through several changes.

The aim of these Schools is fixed by the standard of the examination for an Officer's commission. Improvements, however, in the instruction given by them, make it possible to raise the standard of the examinations. It is this mutual influence of the examinations and the schools that has caused and promises to maintain the steady progress of Prussia's system of military education. As the reforms of the examinations and education have ever gone hand in hand, a history of the Military Schools will present their changes in connexion with those of the system of Examination. From this point of view the development of our Division Schools presents the following periods, each prepared by a gradual transition from the preceding.

First Period, from 1808 *to* 1816.

Foundation of present system of Military Education.

A Cabinet Order of the 6th of August 1808 laid the foundation of the present system of military education. It regulates the appointment of Swordknot Ensigns and the selection of Officers, and declares that the only title to an Officer's commission in time of peace shall be professional knowledge and education, and in time of war distinguished valour and ability. The knowledge required by the regulation from candidates for the Swordknot is defined in Supplement G.

The Cabinet Order of the 6th of August 1808 could only come gradually into operation; the system of Military Examinations had to be created, and the educational institutions had to receive a new organization, under the superintendence of a General Officer. Four Provincial Boards of Examination were successively established, and on the 1st December 1809 a body of instructions, still very vague and general, was issued for their guidance.

The order of 1810 remodelled the Cadet Schools, and founded three Schools for Ensigns, the Staff School, and the General Board of Examination.

A Cabinet Order of the 3rd of May 1810 remodelled the Military Schools, directing, in addition to the Cadet Schools at Berlin and Stolpe, the formation of three Military Schools for Swordknot Ensigns, (*Portepée-Fähnriche*) one at Berlin for the Marches (*Die Marken*) and Pomerania, a second at Königsberg for East and West Prussia, and a third at Breslau for Silesia; and the formation of a Military School at Berlin for Officers. All these institutions were placed under the general superintendence of Lieutenant-General Von Diericke, who had also the special superintendence of the Boards of Examination. A Board of Military Studies was created and entrusted, under his control, with the task of carrying the regulations into effect. As the Military Schools thus established prepared the way for the Division Schools, a circular of the General War Department of the 5th of June 1810 is given in Appendix H, and will enable us to compare the former conception of the Military Schools with their present organization.

Before, however, the new institutions attained to any stability the war years of 1813–14–15 intervened, and the operations of the Board of Examinations ceased.

Second Period, from 1816 *to* 1827.

Soon after the conclusion of peace directions were given that the examinations should recommence, with an equitable consideration of the claims of the Landwehr Officers, Ensigns, and other young persons who had grown up during the war.

Local Boards of Examination established in 1816.

At first there was only one Board of Examination at Berlin, with large discretionary powers as to their mode of procedure. In April 1816, a Cabinet Order was issued to form Boards of Examination for the Swordknot at every Brigade, as the present Divisions were then called, besides the existing Board at Berlin for the examination for an Officer's commission.

The limits prescribed to the examinations in the Order of the 6th of August 1808 continued in force during this period; and neither the regulation of the 26th of April 1816, on the relations and procedure of the Boards of Examination, nor the further draft of instructions of May 1816, define with any precision the standard and nature of the examinations. Still the instructions issued in the course of this period by the Supreme Military Examinations Board to the various subordinate Boards gave a certain clue to guide in some measure the course of education. Contemporaneously with the nine Boards of Examination, the Board of Military Studies, by an Order of January 1816, directed the establishment of Schools for every brigade, and attempted to gradually regulate the instruction they gave. The schools contained two classes, the lower to prepare candidates for the Swordknot, the higher to prepare candidates for the rank of Officer. As, however, no standard of attainment was required for admission into the schools, their instruction had to commence with the first elements, and was charged with more work than it could perform. The weaker scholars stayed two, three, or more years in the lower class, and the education of the better scholars was impeded.

Schools established for every separate brigade; want of system and a fixed standard.

The Schools and the Examinations not placed under one and the same Board; evils hence resulting.

During this and the following period the authority over the Examination Boards (the *Præsidium*) was distinct from that over the schools (the General Inspection), and it was not till later that both authorities were vested in a single person (*See* Supplement I.) This division of powers, intended to secure the independence and impartiality of the examinations, led to the result that the two

authorities were occasionally led, from a difference of principles, to labour in different directions. Still, in the infancy of Military Education, the rivalry it occasioned was favourable to a rapidity of development.

Third Period, from the Year 1827 *to* 1837.

An Order of the 16th of March 1827 prescribed more precisely the standard of the examinations.

French added to the studies for the Ensigns' examination, and a higher standard of attainments in Military Sciences for the Officers' examination.

In the examination for the Swordknot indeed, with the exception of French, it required little more than the Regulation of 1808, but in the Officers' examination, besides the general branches of knowledge taught in the civil schools (with the exception of Latin), a considerably higher standard of attainments was required in the military sciences. It is in this period that the special military education began to be appreciated and enforced.

Nearly at the same time a Cabinet Order of the 27th of March 1827 directed that there should be only one class for Swordknot Ensigns in the Division Schools, and that after October 1829 the candidate should obtain a testimonial of fitness for the rank of Swordknot Ensign previous to admission as a student.

Accordingly young men had to be prepared for examination for the Swordknot at their entrance into their corps, or might prepare themselves by private studies and instruction during their service.

The task of the Schools, still very comprehensive, embracing all the liberal sciences as well as the military, was accomplished during this period in two courses of nine months, in a higher and a lower class.

Fourth Period, from 1837 *to* 1845-46.

Examination for Ensigncy to take place prior to actual appointment;

A Cabinet Order of the 31st of January 1837 introduced the Entrance examination instead of the examination for the Swordknot, it being declared that every candidate for the commission of an Officer, after his reception into a corps, should prove in an examination his possession of the knowledge requisite for a Swordknot Ensigncy before his actual appointment. At the same time a regulation of the Ministry of War, of the 17th of December 1836 (a copy of which is contained in Supplement K.), remodelled and more precisely defined both the Entrance (Swordknot Ensign) examination, and that for the commission of an Officer. This regulation, while it essentially modified the instruction given at the Division Schools, furnished them at the same time with a more certain clue for their guidance. The preparation of youths for the Swordknot examination during their service in the corps was discontinued. But the standard of the Entrance examination was still too low, requiring only a small portion of the branches of a general liberal education, and that not in the shape in which they are taught in our Gymnasia. Hence the evil result, that young men, previous to their entrance into a corps, had usually to prepare for the military profession at private institutions instead of at the Gymnasia, and nevertheless brought with them a very defective amount of preparatory training; on the other hand, the demands of the Officers' examination were very multifarious. It still required the general scholastic sciences by way of formal education, and the military sciences as a special education for the military profession. Thus the task of the Division Schools continued overwhelming, and an aim was set before them which they could not attain.

but owing to the standard of the Ensigns' examination being too low, the task of the Division Schools was too great.

Fifth Period, since the Year 1846.

Principles of the reform begun in 1846.

A Regulation of the 4th of February 1844, in Supplement L., reformed simultaneously the whole system of military examination and education.

The details of the changes both in the examinations and in the teaching of the Division Schools are given at length in the regulations of the 26th and 30th of March 1846 (Supplements E. and F.), and need not here be further indicated.

The views which guided these reforms, the improvements and advantages which were hoped to be thereby obtained, were, in general, the following:—

The Military profession requires a general school education and also professional education.

1. The military profession, like every other, requires a general school education intended generally to cultivate the mind, distinct from the subsequent special and professional education for which the former is the necessary groundwork.

The former is tested in the examination for the Swordknot, the latter in the Officers' examination.

The general education should be given in ordinary civil schools.

2. The preparatory education required from the candidate for a Swordknot is the function of the ordinary Schools of the country. Nothing but what they can impart is required, and from consideration of the youthful age of the candidates (seventeen years), the amount of preparatory training required is not the attainment of the highest class of the Gymnasium, but only that required for admission into the Prima.

3. The required previous training not only gives the candidate a more certain basis for his subsequent military education, but, as being the groundwork of all professions, leaves him afterwards at liberty to cultivate the special knowledge requisite for any profession that he may prefer.

Professional education only to be given in the Division Schools.

4. The Division Schools are freed from a multifarious course of instruction in the scholastic sciences, a task beyond their power; the result of which was that the majority of scholars were very little advanced in formal and general education, and but superficially grounded in the elements of the professional sciences, while they spent years in being drilled for an examination, instead of being educated for life.

Importance of able teachers.

5. If the Division Schools have an able staff of military teachers, they can give a good professional education. (*See* Supplement M.) The younger Officers, even if they never received the full training of the Gymnasium, may still, by their professional training, raise themselves above their subordinates (a class in Prussia often highly educated), and are started with an excellent preparation for their professional career.

6. By the amount of liberal education required in the examination for the Swordknot the friends of those destined for the military profession are admonished to provide them an education equal to that received by the members of other professions.

7. By the method pursued in the Examinations the power is retained of raising or lowering the standard according to circumstances. When the supply of Officers is deficient, the standard can be lowered; at other times, as at present, it may be raised. Since the above-mentioned regulations, the following essential alterations have been introduced :—

The examination for the Ensigncy is again placed after admission to the Corps.

1. The examination for the Swordknot is again placed after admission into the corps, but no one can be admitted to attend the Division Schools without a testimonial of fitness for the rank of Swordknot Ensign.

A body of highly educated officers, supplied by the select class of the Cadet Corps, and by those who have passed the Arbiturient examination.

2. A testimonial of fitness for the University, *i.e.*, to have passed the Abiturient Examination, dispenses with the Examination for the Swordknot. In consequence of this rule fifty Abiturients on an average annually enter the army. These, as well as the Selectaner of the Cadet corps, must be considered, in point of scientific education, an excellent supply of Officers. From the powerful impulse that military instruction has received in the last fifty years, it may be expected that the time is not distant when the candidate for an Officer's Commission, instead of passing the Swordknot Examination, will have to bring the finished training of the Gymnasium; in other words, to have passed the Abiturient Examination.

Reduction in the number of Division Schools.

3. Instead of the seventeen Division Schools there are now by the Regulation of 1844 only nine, and a further reduction of their number to four or three is contemplated, with an improvement of the staff of teachers and a stricter supervision of the scholars.

Importance of confining the Officer's examination to professional subjects.

If any State desire to create an institution similar to our Division Schools with a prospect of success and prosperous development, I would recommend the following arrangements :—

1. In the first place let the Officer's Commission depend (besides a period of actual service and any political qualification suitable to the country) on successfully passing an Examination. Beware of fixing the standard too high at first, and keep in mind the education which the Schools of the country are capable of giving. Confine the Officer's Examination to professional subjects, such as the Organization of an Army, Service within Lines and in the Field (*Linien* and *Felddienst*), Petty Tactics, Arms and Munitions, Artillery, Fortification, Attack and Defence of Works and Fortresses, Drawing and Surveying (*Aufnehmen*).

The Supplements K. (under Section B.) and F. (from page 31,) contain suggestions on this point.

2. Organize a Board of Examination, presided over by a Field Officer of high

rank. Let it consist of four members, or, at least, so many as there are subjects of examination. Regulate the procedure of the Board in the Examinations, in the mode of judging and determining the result. Suggestions on this point are contained in Supplement F.

Appoint a Board of Examiners, presided over by a Field Officer of high rank.

3. Open under the direction of a Field Officer of high Rank, first a single Military School, where the knowledge required in the Officer's Examination may be acquired. Appoint first-rate teachers, for this is the mainspring of success. Require of the students at entrance an amount of previous training adjusted to the capacity of the Schools of the country, and adequate as a basis for their professional studies. Provide energetic young men for the superintendence and assistance of the students. Keep the method of instruction as simple as possible; and combine theoretical instruction with multifarious applications and practical illustrations.

Importance of first-rate teachers, and of an adequate previous training, as a basis for professional studies.

Further, endow the School abundantly with apparatus of every kind, models, instruments, plans, libraries, &c. If the amount of the previous knowledge which the scholars bring make it desirable to include in the course the lower mathematics and one living language, the course must extend over two years. For the military sciences, with good teachers, one year would be sufficient.

For the organization of the School, Supplements E. and M. contain suggestions. When the School is started, if there is a sufficient supply of teachers, open another to create competition between the two.

4. The Board of Examination and the Schools should be quite independent. The Examiners must not be teachers in the School, especially at first, in order that their influence on the instruction may be as effective as possible. Both authorities, however, should be subordinated to a single chief, to whom should be attached a Board of scientifically educated Officers, and learned men versed in the practical sciences.

The Board of Examiners and the schools should be quite independent.

VON HOLLEBEN,
Lieutenant-Colonel and Adjutant of the General Inspection of the Department of Military Instruction and Education.

Berlin, 18th of June 1856.

To this valuable communication are appended a series of supplementary papers, giving a complete documentary history of the changes in the system.

A. Directions for the Supreme Board of Military Studies, with a copy of the Cabinet Order of 20th December 1855. Berlin, 24th May 1856.
B. Directions for the Board of Studies of the War School; same date.
C. „ Division Schools; same date.
D. „ Cadet Corps; same date.
(These are all translated in the Appendix.)*
E. Regulations for the Division Schools, 1846 (contained partly in the account of those Schools.)
F. Regulations for the Examinations, 1846 (contained partly in the account of the Examinations.)
G. Copy of the Instructions for the Examination Commission for *Portepée-fähnriche* and Officers, issued in 1808.
Ad. G. Extract from Regulations of the 6th of August 1808.
H. Circular of the 5th of June 1810.
I. List of General Inspectors and of Members of the Præsidium; *i. e.*, Presidents of the Supreme Examinations Commission.
K. Regulations as to Admission, &c. of the 17th of December 1836.
L. Regulations of the 4th of February 1844.
M. Regulations as to the Practical Exercises in the Division Schools, 1847.

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* See Appendix V.

SECTION VI.—TRANSLATION OF OFFICIAL DOCUMENTS RELATING TO THE ARTILLERY AND ENGINEERS' SCHOOL.

Object.

The object of the Artillery and Engineer School is to give to such young men of the Artillery and Engineers as have been found fitted for promotion, the education necessary for the proper performance of the duties of a Subaltern Officer, and to enable them to draw profit afterwards from their private studies and the practice of the service.

Course of instruction.

The complete course of study lasts two years and three quarters. The instruction is divided into three courses, bearing the name of *cœtus:* on joining the institution the young men enter the first cœtus. Before the commencement of the studies, that is, about the 1st of October, the General Inspectors of the two Corps direct the young men who are to enter the School to come up from their regiments and divisions. They receive their pay and clothing from their regiments until they are promoted to the rank of Officer.

Theoretical and practical.

The first nine months of each year of study are principally devoted to theoretical instruction, the three last exclusively to practice. In the third cœtus, the course finishes with the theoretical instruction on the 1st of July.

Instruction in the 1st cœtus,

The instruction of the first cœtus is directed to prepare the students for the ordinary Officer's Examination (*Armee-Officier-Prüfung*), and at the same time to enable them to follow with advantage the further studies of the School. The instruction, during the first year, is common to all the students. Those who pass the Officer's Examination enter at the commencement of the second year into the second cœtus.

in the 2d cœtus, in the 3d cœtus.

In the second cœtus the greater portion of the instruction, but not the whole, is common to the two arms. In the third cœtus an almost entire separation of studies takes place.

In all the studies which are common to the two arms, if the number of students is too great for a single class, parallel classes are established.

The Personal.

A.—The Superior Authorities.

Establishment. Curatorium.

The *Curatorium* of the School is composed of the General Inspectors of the two Corps. To it belongs the authority of issuing orders and regulations; no important change in these can be made without its sanction.

Reports to the General Inspector of Military Instruction.

The General Inspector of Military Instruction (*Militair-Erziehungs-und-Bildungs-Wesens*) receives yearly at fixed periods reports upon the state and progress of the School.

The accounts are under the control of the War Department, with which the Director of the School is in immediate communication. Questions of principle and unforeseen cases of importance are decided by the *Curatorium.*

Inspection.

The Inspector of the School, who is an Engineer Officer when the Director is an Artillery Officer, and *vice versâ*, has the immediate oversight of it. It is his duty to see that the orders and regulations are strictly followed.

B.—The Executive Authorities.

Direction.

The Director is appointed by the King. He is a Field Officer of either Artillery or Engineers, and has the rank of Commandant of a regiment. He has as assistant, a Captain appointed by the *Curatorium.* The Director is immediately responsible for the discipline and the finance of the establishment, and conducts its ordinary details, assisted by the Captain. He is also President of the Board of Studies; as such he exercises a general control over the instruction, and regulates the ordinary examinations.

Direction Officers.

Under the Director and the Board of Studies are four Officers (*Directions-Officiere*), three taken from the Artillery and one from the Engineers. They have the immediate charge of the students, and are themselves under the direct orders of the Captain.

The duties of Paymaster, Librarian, &c., are divided among them. They must also give at least two hours of instruction weekly to the pupils.

Board of Studies.

The Board of Studies consists of the Director of the Institution as President, and usually of the Senior Master of Mathematics, and the Instructors of Artillery and Engineering in the third cœtus. In equal numbers are likewise added Superior Officers of the Artillery and Engineers appointed by the *Curatorium.* The duty of the Board is to control the whole of the instruction,

and to give an opinion when required upon the performance and capacities of the teachers and students.

C.—The Teachers.

Teachers as much as possible Officers of Artillery and Engineers.

The Teachers are to be selected as much as possible from among the Officers of Artillery and Engineers. Where this cannot be effected, civilians of proved ability and experience are to be appointed.

Their number.

The number of Teachers is to be arranged with reference to the amount and extent of the studies, in such a manner that in the event of illness among them, no interruption in the instruction may arise. In addition to the Teachers, there is a certain number of assistant-teachers, partly civilians, partly taken from among the fire-workers of the Artillery. The latter are employed under the Librarian, and in the practical instruction; they may also, in case of necessity, assist as clerks.

The Students.

Number of students.

The maximum number of students who enter each year is 80; 60 from the Artillery, and 20 from the Engineers. In addition, a few young men may be received from the smaller German States. In the event of the number from one Corps being short, an increased number may be admitted from the other.

The number in the second cœtus is variable. It consists, first, of the students previously in the first cœtus who have passed the Officers' Examination; and, secondly, of such young officers as are appointed to the Institution by the General Inspectors.

Students of 1st year lodge in the school buildings.

The students of the first cœtus lodge, as far as room will admit, in the school buildings; the remainder, as well as the Ensigns of the second cœtus, not yet promoted to Officers, are quartered in a neighbouring building. At least two of the Direction officers lodge in the school buildings; a third lodges in the other.

The Director may grant permission to a student, as a matter of favour, to lodge with his parents.

The students quartered in the school and the neighbouring building dine together in the mess-room of the school.

Students of 2d and 3d year lodge in the town.

The officers (students) of the second and third cœtus live in lodgings in the town, and mess where they choose.

Entry into the School, and Passage through it.

First Cœtus.

The entry into the first cœtus of the institution is conditional on the applicant having passed, in the manner officially prescribed, the examination for Ensign. The necessary certificates are forwarded to the Director of the School.

Instruction generally a preparation for the ordinary Officer's Examination.

The instruction in the first cœtus embraces in general the subjects required for the ordinary Officer's Examination, that is to say, the elements of Military Science, so far as every Subaltern Officer is obliged to know them. To this is to be added instruction in mathematics, in French, and in free sketching.

At the commencement of the instruction the teachers inspect the whole of the Ensign-Examination papers of the newly-arrived students, which are laid before them by the Director, in order the better to judge of their acquirements. During the first quarter they take pains to ascertain the ability as well as the amount of acquirements of each student, so as to be able to give a confident opinion upon him at the end of the quarter.

Conference of teachers at the close of the 1st quarter.

Recommendation for promotion of last joined to rank of Ensign.

After the close of the first quarter a conference of the teachers, under the presidence of the Director, takes place, to form a report upon the students, and to furnish data for recommendations to the rank of Ensign of such students as have given satisfaction by their conduct and progress. The students, about whom the teachers have not yet been able to speak confidently, who, in certain studies, as in mathematics and the special branches of their arm, are behindhand, as well as those whose conduct has not been without blame, are proposed to the higher authorities for permission to continue to remain at the School. On the other hand, the Board of Studies proposes for dismissal from the institution students whose conduct has been unsatisfactory, and principally who give too little hope of a favourable career. The Board is to express an opinion whether any prospect may be held out of a future recal to the institution, according as its unfavourable report has been founded on the want of ability or on the want of industry of the student.

The students favourably reported on are immediately, by the General Inspectors, appointed Ensigns, subject to vacancies. The *Curatorium* decides regarding the further stay at the Institution, or the dismissal of the others.

After the end of the second quarter those pupils who cannot yet be recommended for promotion to Ensign are only in special cases allowed to remain till the end of the theoretical instruction of this year; if they cannot then be recommended, they are sent back to their regiments.

Selection of Students of 1st year to present themselves for the *Officer's Examination.*

Fourteen days before the close of the theoretical instruction for the year, that is to say, about the middle of June, the teachers give an opinion regarding each student of the first cœtus, as to whether or not they consider him capable of undergoing the Officer's Examination, and to pass into the second cœtus. These reports, joined to that of the Director, as regards the conduct of the students, enable the Board of Studies to propose to the higher authorities either that permission may be granted to undergo the Officer's Examination (and, if successful, to enter the second cœtus), or that the student be sent back to his Corps. Students who have been refused permission on grounds not altogether unpardonable from presenting themselves for the Officer's Examination, or who in the course of instruction have been sent for any reason to their corps, with the prospect of being afterwards called back to the School, may, on the proposition of the Board of Studies, through the *Curatorium*, be granted a second and final entry into the first cœtus.

The *Curatorium* decides in every case whether a student who has not qualified himself for entry into the second cœtus, may return to the first cœtus after having left the institution, or in case he shall have in the meantime passed the Officer's Examination, whether he may, as an exceptional case, enter the second cœtus. In a case of the latter kind, the applicant cannot present himself for the Officer's examination without having previously passed a preliminary examination at the School, to do which, the permission of the General Inspector of his Corps is necessary.

Theoretical class closes at the end of June.

Surveying.

Examinations.

The theoretical course closes at the end of June. During the month of July the students of the first cœtus are employed in surveying operations. It is during this month that the examinations for the rank of Officer before the General Examining Board (*Ober-Militair-Examinations-Commission*) takes place. The students who pass this examination enter afterwards into the second cœtus; those who fail are, at the expiration of the practical course of their year, sent back to their Corps.

Students who have passed the *Officer's Examination* proposed to the Officers of their Corps, for election.

The students who pass the Officer's Examination, and are found qualified to enter the second cœtus, are then proposed for election to the Officers of their Corps. If the decision be favourable, their names are submitted by the General Inspectors to the King to be appointed, on vacancies occurring, to the rank of Supernumerary (*Ausseretatsmässigen*) Second Lieutenant.

To assist the Officers of the Corps in making their election, an extract of the reports above alluded to is sent to them, so far as it concerns the students who have successfully passed their Officer's Examination.

Second Cœtus.

Students all Officers.

It is an indispensable condition for entering the second cœtus that, if a student of the first cœtus, he should have passed the Officer's Examination, or if he should now enter the school for the first time, that he should have the rank of Officer. The sum of acquirements necessary for the Officer's Examination forms the basis of the instruction given in the second cœtus. In it the instruction ceases to be entirely common to the two arms.

Selection of Students to present themselves for the *former part* of the *Special Corps Examination.*

Officers not qualified for the Special Corps may be transferred to the Line.

At the end of the theoretical course of the second cœtus, a report of progress and conduct is drawn up, as in the first cœtus, by the Board of Studies, on the data furnished by the teachers as regards the studies, and by the Director as concerns the conduct of the students. In forwarding this report to the *Curatorium*, it is stated for each student whether or not he is considered qualified to pass the *former part* of the Special Corps Examination (*Berufsprüfung*). Those who are unfavourably spoken of in this respect return to their Corps if there are no mitigating circumstances which permit a further stay in the second cœtus, following the decision of the *Curatorium.* They may either endeavour to obtain a transfer into another branch of the Army, or by study and good conduct prepare themselves for admission into the third cœtus at a future period. But in this case they must not only be recommended by their Corps, but they must also pass the *former part* of the Special Corps Examination.

Board of Examiners for this Examination.

Subjects of Examination.

The students recommended to present themselves for the *former part* of the Special Corps Examination undergo it before a Board appointed by the chiefs of the two Corps in the beginning of July. It extends over the subjects of professional science which have been taught in the second cœtus. A particular

regulation defines the mode of this examination, which is entirely written; it decides whether the Student shall enter or not into the third cœtus.

The successful students pass, by direction of the *Curatorium*, into the third cœtus, while the unsuccessful ones, as well as those who have been reported unfit to undergo the examination, return to their Corps. By good conduct and study they may obtain permission to come up again at the next examination for the *former part* of the Special Examination. Their definite return to the School depends upon their passing this examination, and upon the express order of the *Curatorium*.

Third Cœtus.

The instruction in the third cœtus is chiefly directed to supply the special scientific knowledge required by each of the two arms. The students of the two Corps, therefore, receive separate instruction. A further object of the instruction is to enable the students to make use of the knowledge which they have acquired, on which account instruction and practical application go hand in hand. Practice and theory go thus together in this the highest portion of the instruction, so that they both terminate at the same time, namely, at the end of the month of June.

Instruction separate for the two Corps.

Latter part of Special Corps Examination.

Previous to leaving the School, the *latter part* of the Special Corps Examination is undergone before the same Board as for the *former part*. This examination tests their qualifications in their special arm, and proves their fitness for Artillery or Engineer Officers. The results of this part of the examination and of the former part of it passed at the close of the second cœtus, are combined by the Board, and forwarded to the *Curatorium*. Along with these reports is submitted a proposition for those who have passed the examinations to be admitted into their Corps. In the preparation of the patents (for commissions), they are ante-dated to the time of passing the Officer's Examinations, proper regard being had to the results of the Special Corps Examination for arranging the Officers among each other.

Arrangement of seniority among the Officers.

Officers failing in the *Special Corps Examination.*

Any Officer who does not pass the Special Corps Examination remains with the pay of an Infantry Officer in his Corps until he either enters into another arm, or having obtained permission to re-enter the third cœtus, he qualifies himself for the final examination. A successful passing of the Special Corps Examination at this second trial can give, under the most favourable circumstances, no higher seniority than that of immediately after the Officers who have passed their examination the previous year.

A. *The Instruction in General.*

The general instruction may be divided into—

Instruction. Theoretical.

1. The theoretical part, designed with the view to the practical professional requirements of the Students, and their further self-improvement.

The instruction ranges over—

(*a.*) Artillery.
(*b.*) Military Engineering.
(*c.*) Hydraulic Construction.
(*d.*) Elements of Tactics.
(*e.*) History of the Art of War.
(*f.*) Mathematics.
(*g.*) Theory of Surveying.
(*h.*) Physics.
(*i.*) Chemistry.
(*k.*) French Language.
(*l.*) Rules and Regulations of the Service.
(*m.*) The Horse.
(*n.*) Plan Drawing.
(*o.*) Free Sketching.
(*p.*) Descriptive Geometry.
(*q.*) Artillery Drawing.
(*r.*) Artillery Constructions Drawing.
(*s.*) Fortification Drawing.
(*t.*) Architectural Drawing.

Practical.

2. The practical part of the instruction, designed by a series of practical exercises to exhibit the application of the theory taught, and to extend the knowledge previously acquired.

The practical part includes:

(*a.*) Visits to the Military Establishments and Institutions in Berlin and Spandau, examination of the objects, collections, models, &c. which they contain.
(*b.*) Chemical manipulation.

(*c.*) Examination of raw materials, of cannon, limbers, and ammunition waggons, of shot and shells, and of small-arms.
(*d.*) Management of Machines.
(*e.*) Practical exemplification of the rules for placing guns with reference to the ground, and to tactical considerations.
(*f.*) Marking out and tracing batteries and field-works.
(*g.*) Drawings from Artillery objects, and from buildings, &c.
(*h.*) Being present at the practical operations of the Engineer Division of the Guards.
(*i.*) Solution of problems in the attack and defence of fortresses.
(*k.*) Practice in Elementary Tactics.
(*l.*) Practical surveying.
(*m.*) Artillery practice.

Military exercises.

3. A course of Military and Gymnastic Exercises, requisite to prepare Officers for active Military Service.

They are divided into—

(*a.*) Exercises on foot.
(*b.*) Exercises with the different kinds of Guns in position.
(*c.*) Fencing and Gymnastics.

B. *Instruction in Detail.—The Theoretical Part.*

Theoretical studies, their length.

The theoretical studies commence each year on the 1st of October, and end on the 30th of June. They may be reckoned, after deducting the vacation and holidays, to include a period of 35 weeks.

Generally only in the forenoon.

As a general rule, the studies take place only in the forenoon, namely, during the five hours between eight and one o'clock. Occasionally only are there hours of study for a small part of the Students in the afternoon. A portion of the afternoons, during the theoretical course, are employed for drills and practice, but in no case more than twice a week, in order that the Students may have the necessary time for recreation. The Students are required (those who are officers excepted) to remain in their quarters in the evening, to prepare the work which has been allotted to them by the teachers.

The parallel classes of each cœtus, with the exception of the drawing classes, are, as a general rule, to be under the same teacher.

Arrangement of Theoretical Instruction.

The theoretical instruction is distributed as follows

AMOUNT OF STUDIES, WEEKLY.

NATURE OF STUDY.	First Cœtus.	Second Cœtus.		Third Cœtus.	
	Artillery and Engineers.	Artillery.	Engineers.	Artillery.	Engineers.
Artillery	4	3		8	0
Military Engineering	4	3		0	10
Hydraulic Construction	0	0	0	0	2
Elements of Tactics	4	0	0	0	0
History of the Art of War	0	3		0	0
Mathematics	6	6		In two divisions. 4	
Theory of Surveying	2	0	0	0	0
Physics	0	4		0	0
Chemistry { Lectures	0	0	0	4	
Chemistry { Manipulations	0	0	0	4	
French Language	2	2		2	
Rules and Regulations of the Service	2	0	0	0	0
The Horse	0	0	0	2	0
Plan Drawing	4	2	4	2	3
Free Sketching	2	0	2	0	0
Descriptive Geometry	0	1		0	0
Artillery Drawing	0	2	0	3	0
Artillery Construction Drawing	0	2	0	2	0
Fortification Drawing	0	4		0	4
Architectural Drawing	0	0	2	0	3
	30	32	34	31	36

Remarks.

In the first cœtus.—All the instruction in this class is common to the two arms, and is equally divided among the six forenoons of the week. Instruction in 1st cœtus common.

In the first and second cœtus.—With reference to the mathematical instruction, it is particularly ordained, that each of the two Mathematical Teachers shall give instruction to the same students in the first and second cœtus, so that the one who teaches in the first cœtus one year, teaches in the second cœtus the year following.

In the second cœtus :— in 2d cœtus begins to be separate,

1. The larger portion of the instruction, as the Table shows, is common; in Plan Drawing the only difference is that the Engineers receive two hours' additional instruction.
2. The instruction in French, for a select number of the most advanced students only, takes place on two afternoons.
3. The instruction in Free Sketching for the Engineers takes place also on two afternoons.

In the third cœtus :— in 3d cœtus about one-half common.

1. About one-half only of the instruction in this class is common; in Plan Drawing the Engineers have one hour more instruction a week.
2. The Chemical Manipulations (in which a very small number only of the students share) take place on two afternoons.
3. The instruction in French, in which only those already selected in the second cœtus take part, also is given on two afternoons.
4. For mathematical instruction the class is formed into two divisions; The first consists of those pupils who, in the opinion of the teachers, are able to follow profitably the instruction in the Higher Mathematics. The remainder form the second division, and go over a second time what they have already learned, to which is added a variety of questions in Applied Mathematics, important to the Artillery and the Engineers. Two mathematical classes.

Tenor of the Studies in General. Studies in general.

Artillery.—Elementary description of all the *matériel* of the Prussian Artillery, and of the basis of its arrangement. Effect of the different natures of Guns, and the simplest rules for their employment. 1st Cœtus.

General Military Engineering.—The Elements of Field and Permanent Fortification. The principles of the Attack and Defence of Fortresses. General notions on the Construction of Military Bridges.

Tactics.—General Organization of an Army. Formation of the different kinds of troops. Fundamental rules for the placing, moving, and fighting of the separate arms, as well as their combination. Occupation of ground. Attack and Defence of positions. Field-service.

Mathematics.—Algebra and Arithmetic. Simple and Higher Equations. Progression Series. The Binomial Theory for Integral Exponents. Series of Powers and Logarithms. Analytical Trigonometry. Plane and Analytical Geometry. Plane Trigonometry.

French Language.—Translation from French into German, with parsing.

Rules and Regulations.—Official correspondence, with examples. Discipline. Military Code. Courts-martial. Courts of Honour. Service in and out of garrison.

Plan Drawing.—Theory of representing ground. Principles of Topography. Surveying. Drawing from copies and simple models. Knowledge and description of the different conventional marks.

Free Sketching.—Drawing of straight lines, broken lines, and angles. First principles of figure drawing. Hatching with black chalk. More difficult studies in figure drawing.

Artillery.—Description of the organization of the Prussian Artillery. Rules for the employment of Artillery in the Field and in Sieges. 2d Cœtus.

Special Military Engineering.—Extension of the course of Field and Permanent Fortification, given in the first cœtus. Extension of the instruction on Sieges. Formation of Camps. Specialities of Military Engineering, in so far as it is of interest to Artillerists.

History of the Art of War.—History in early times, in a very general manner; that in the middle ages, as they approach modern times, in greater detail; in modern times, very fully. Organization of the armies and mode of conducting war at each remarkable period, illustrated by the description of some campaigns and great battles.

Mathematics.—Solid Geometry. Spherical Trigonometry. The theory of projections. Theory of Co-ordinates and Conic Sections. Statics, Geostatics, and Hydrostatics.

Physics.—General properties of bodies. Laws of the equilibrium of solid, fluid, and aëriform bodies. Heat. Application of steam and gases. Measurement of heights. Hygrometry. Acoustics. Optics. Magnetism. Electricity. Electro-magnetism. Magneto-electricity.

French Language.—Exercises in translating German into French, for a select number of the pupils, about one-third of the whole.

Artillery Drawing.—Use of drawing instruments and scales. Drawing of the *matériel* of the Artillery, and principally of the separate parts of an object in different views and sections, to a certain scale, without the original.

Artillery Constructions Drawing.—Construction of the different limbers, gun-carriages, &c., and the principles of their arrangement, forms, proportions, and admeasurements; in greater part, however, intended only as illustrations of the rules of perspective.

Fortification Drawing.—Instruction in the composition of drawings; the practice includes representations of projects of Fortresses and of their details in plan and section, and in cavalier's perspective (bird's-eye view); both etched and shaded with Indian ink, and coloured. The chief object is to qualify the pupils to understand, and to prepare correctly, drawings and plans of objects in Field and Permanent Fortification.

Plan Drawing.—Further practice in drawing of ground, with objects, buildings, &c., marked in black and colours. Further progress in Geodesy. Sketches and reconnaissances.

Architectural Drawing.—Perspective. Drawings of architectural decoration in outline, with the lines of shadow, but without further detail.

Free Sketching.—Further figure-drawing. Landscapes and the drawing of ornaments, for the more skilful students.

Descriptive Geometry.—The theory of descriptive geometry. Projections of various bodies in space, upon planes. Drawing according to proportional scales. Theory of light and shade of drawings.

3rd Cœtus.

Artillery.—History and literature of Artillery. Review of the general relations of the Artillery system in the principal States of Europe. Scientific basis of Artillery objects, and their technical description. Theory of the Parabola and of projectiles. Organization and employment of Artillery considered in its highest point of view.

Exclusive Military Engineering.—Special application of the rules for Sieges under given circumstances more or less connected. Complete instruction in Building, and its application shown by projects for given sites.

Hydraulic Constructions.—General principles of the Science. Knowledge of the construction of such works, of which the principles should be known to Engineer Officers. In this is chiefly to be considered fascine work for the protection of the banks of rivers and canals, the construction of bridges and sluices, and the laying the foundation of heavy masonry in water.

Mathematics—(For the first division, about a quarter of the class.)—Differential and Integral Calculus. The higher Geometry. Analytical Mechanics and Hydraulics.

(For the second division, about three quarters of the class).—Repetition of the most important part of the studies already gone through in the first and second cœtus, with practical useful problems. Mechanics and Hydraulics, as well as some instruction necessary for artillerists, but so as not to require the higher analysis, and more of a practical than of a theoretical nature.

Chemistry (Instruction).—The necessary preliminary knowledge of theoretical principles. Treatise of separate substances (of the metalloids and their indifferent combinations, of the acids, of the metals), all illustrated by experiments. To conclude with a survey of the composition and alteration of the surface of the globe from a chemical point of view.

(Manipulation).—Instruction in the principles of qualitative Chemical Analysis, illustrated by experiments. Manipulation by the students under the superintendence of the instructor. Instruction in the principles of quantitative analysis. Analysis by the students of substances employed by the Artillery. (Only four or five of the best qualified take part in these experiments.)

French Language.—Select conversation (only for the already selected students in the second cœtus).

The Horse.—Natural history and anatomy of the horse. Good and bad points. Food. Internal and external sickness, with the mode of discovery and cure of the same, as far as practicable, by the means to be had on actual service. Shoeing.

Artillery Drawing.—Continuation of the instruction. *Matériel* of the Artillery, represented as combined Artillery objects, partly on a given scale, partly drawn from a real object, by the more skilful students.

Artillery Construction Drawing.—Construction of each description of Cannon. Principles of their forms, proportions, and sizes. Problems on the construction of existing and not existing Guns, Carriages, &c. Construction of the Artillery *matériel* of foreign Powers.

Fortification Drawing.—Projects of Field Fortification, to be constructed of earth, or of earth and gabions, with application to the nature of the ground. Drawings with the use of Von Prittwitz' copies of the fortification of places, as a continuation of the fortification Drawings begun in the second cœtus. For all these exercises in projects and drawings, the concert of the Teacher of exclusive Engineering is required.

Plan Drawing.—Practice in copying and reducing large Plans. Drawings of Plans of Battles with the position of the troops, and of Plans of Sieges, with the trenches and batteries.

Architectural Drawing.—Architecture in its application to military buildings, done in India-ink. Finally, practical exercises in copying buildings.

Practical Exercises.

Practical exercises principally take place in July, August, and September.

These are carried on, as has been already remarked, in part during the nine months of theoretical instruction, on some of the afternoons, but they principally take place during the three summer months of July, August, and September, in the forenoon. They commence early in the morning and often last till the afternoon, on which account there are no evening hours of study during this period. As the students of the third cœtus return to their corps at the beginning of July, those of the first and second cœtus only take part in this practice. The visits to the Fortress and Military Establishments of Spandau, and the preparation of projects of military constructions, and of reconnaissances, must be made during the period of theoretical instruction. It is therefore suspended for one day for the students of the first cœtus, and for three days for the Artillery, and five days for the Engineer students of the third cœtus.

The distribution of time for each cœtus is as follows:—

During the Nine Months of Theoretical Instruction.

—	Number of Days employed.				
	First Cœtus.	Second Cœtus.		Third Cœtus.	
	Artillery and Engineers.	Artillery.	Engineers.	Artillery.	Engineers.
Visits (to begin middle of February):					
To the Artillery workshops (for the third cœtus, examination of raw materials included)	2	0	0	4	0
To the Collection of Arms in the Arsenal	1	0	0	0	0
To the Models of Fortresses in ditto	1	0	0	0	0
To the Ordnance, Gun-carriages, Ammunition-waggons, &c., in ditto	4	0	0	0	0
To the Foundry and Boring Machinery	2	0	0	2	0
To the Iron Foundry, and to one of the large Manufactories of Machinery in Berlin	0	0	0	2	0
To the Fortress of Spandau, the Powder Mill and Small-arm Factory	1	0	0	0	0
Working in the Laboratory	12	12	12	0	0
Examination of Ordnance	0	0	0	6	0
Examination of Gun Carriages, and Ammunition Waggons	0	0	0	6	0
Examination of Shot and Shell	0	0	0	2	0
„ of Small Arms	2	0	0	0	0
Practical representation of the Rules for placing Guns:					
With reference to the Ground	0	2	2	0	0
On given tactical conditions	0	0	0	¼	0
Solution of Problems in the Art of Sieges, with reference to an actual Fortress, and the country surrounding it (Spandau)	0	0	0	3	5
Practice in Elementary Tactics	4	0	0	0	0
Drawings of Ordnance, Carriages, &c.	0	12	0	0	0
„ of Buildings, &c.	0	0	0	0	14
Practice in Geodesy	12	0	0	0	0

During the remaining Three Months.

Practice in Geodesy	16	28	32	Nil.
Practice in Fortification of the first cœtus, with the Engineers of the Guard	12	0	0	„
Practice in Fortification of the second cœtus	0	10	10	„
Visits to the Models of Fortresses in the Model-house	0	2	2	„
Gun Practice, proof of Gun Powder, the management of Machines, &c.	14	14	14	„

Remarks.—The employment of time in the last three months above given, requires the whole of the months of July and August, and about the first third of the month of September, after deducting fourteen days for the Officer's examination for the first cœtus, and occasional days lost through bad weather. The remaining two-thirds of September are given for vacation, as well to afford recreation to the teachers and students as to allow of the repairing and cleansing of the School-buildings.

The vacation.

Military and Gymnastic Exercises.

The month of October is appointed by the Director to the fitting and making uniform the regimental clothing brought with the students from their Corps. Military exercises then take place once a week for two hours in the afternoon, till the 1st of April, or for about five months.

Military exercises.

The military exercises are carried on under Officers of the garrison, namely, a Captain and two Lieutenants of the Artillery of the Guard. They put themselves in communication with the Director to arrange the time, nature, and extent of the exercises.

The exercises consist of—

1. *Exercises on Foot.*—The whole of the first cœtus here take part, but only so many of the second cœtus as are required as Non-commissioned Officers. Considering the composition of the squad (Artillery and Engineers), and the object of the exercise, the perfection of the students in company-drill is less to be attempted than the endeavour to give to each a good position and carriage in the front as well as in the ranks, and more particularly to accustom them to military order and precision.

2. *Exercises with different descriptions of Guns in Position.*—In preference, the light field pieces of the year 1842 are to be used for drill, and correct, united, and prompt execution required. With the siege-guns, every student is instructed and practised with at least one calibre of each nature.

In addition to their military exercises, there are also—

3. *Fencing and Gymnastics.*—In these exercises the students of the first cœtus only take part, and for two hours of the afternoon each week, during the first six months. There is neither time nor appliances to admit of the students arriving at a high state of excellence. The practice in fencing is only intended to give confidence in the use of arms, that in gymnastics to produce activity, and to afford bodily exercise to young men much occupied in study.

Examinations and Censures.

Examinations.

In addition to the several examinations already enumerated, by which the fitness of the students for a certain rank or for promotion into a higher cœtus is shown, some other examinations take place.

1. For the purpose of enabling the Director and the Board of Studies to learn the progress of each separate student, and to confirm by their own knowledge the opinion given by the Teachers: there is twice in each quarter an oral repetition of some portion of such instruction in the first and second cœtus. The period of the examination is previously named by the Director.

2. To give a general view of the progress of the entire year, and to incite the students to study, a public oral examination of those in the first cœtus takes place at the close of the theoretical instruction, in presence of the higher authorities of the School, Superior Officers of the two arms, and other persons interested.

Quarterly *censures* read out to cœtus.

As a further incitement to the students, and as a warning to those whose diligence or conduct has not been satisfactory, the quarterly "censures" are read out to the assembled cœtus. In general the names of the students are not mentioned, a number known to the individual only being used instead. The best pupils are, however, openly commended by name.

Best students alone mentioned by name.

In 1st cœtus, different.

In the first cœtus, on the other hand, those pupils who have obtained very bad "censure" are mentioned by name.

Financial Relations.

The annual expense of the School is fixed at 16,049 Dollars. The sum is distributed as follows:—

Personal.		
Salaries and allowances of Teachers	10,731	
Pay and allowances of the Staff	3,478	
		14,209
Practical exercises	520	
School necessaries	720	
Keeping up materials for instruction	110	
Cleansing the rooms	130	
Lighting	100	
Bureau expenses	210	
Covering unforeseen expenses	50	
		1,800
		16,049 Dollars.*

In the event of war, and if the instruction is suspended for an indeterminate period, the salaries of the civil Teachers cease. Application is not to be made to the King for the grant of a provisional indemnity, except under very peculiar circumstances.

The payment of the salaries and allowances is made monthly and in advance.

The administration of the funds is directly under the supervision of the Director. The Treasurer carries out the details. The superior orders for the administration of royal grants are most strictly to be followed.

The annual accounts are forwarded by the Director to the War Department.

The property of the School consists of:—

The Library, the Collection of Instruments and Models for Artillery and Engineers, the Collection of Physical Instruments, the Collection of Chemical Apparatus and the School Utensils.

The principal object of the Library is to serve as materials of instruction for the Teachers and Students, and the Officers of Artillery and Engineers present at the Institution. After that, as a centre, for the collection of all the best works, old and new, on Artillery and Military Engineering.

The Director and Board of Studies take care that the Instruments and Apparatus for the studies are always kept complete and in good order. As the means of the school do not thoroughly admit of the collections keeping pace with the progress of science, special care is taken that at least the most necessary articles are not absent.

The utensils of the school are kept always complete, under the supervision of the Director.

The property of the School is examined yearly by the Director and Board of Studies, and a report to that effect sent in with the annual accounts.

Regulations for the Special Corps Examination (*Berufs-Prüfung*) of the Second Lieutenants of Artillery and of Engineers.

General Definitions.

Object of Examination.

The principal object of this examination is to afford the young Officers educated at the "Artillery and Engineers School" the opportunity of exhibiting the requisite proficiency in the scientific requirements of the arm which they have selected.

The *former part* of the examination serves also to ascertain the fitness of the students of the second cœtus to enter the third cœtus, and also to determine which of them are to form the higher mathematical class of the latter cœtus.

Division of the Examination.

The examination extends over all the direct and auxiliary sciences, and graphical representations, which are subjects of instruction in the second and

* This amount differs slightly from that given at page 89.

third cœtus of the "Artillery and Engineers School." It is divided into two parts.

The *former part* of the examination.

The *former part* includes all the direct and auxiliary sciences taught in the second cœtus, and takes place for the students of this cœtus at the end of the theoretical course. The examination for surveying, however, is postponed until the termination of the practical exercises.

Those students only who pass this portion of the examination move up into the third cœtus of the Artillery and Engineers School.

The *latter part* of the examination.

The *latter part* of the examination takes place at the close of the studies of the third cœtus.

Both parts take place in the beginning of July.

With the single exception of the portion of the examination which has reference to surveying, both parts of the examination take place in the ordinary school year, in the first half of July. The *latter part* of the examination, however, always takes precedence of the *former part*, in order not to detain the students who have completed their third year from proceeding to join their corps.

Questions in *former part*, the same.

As the instruction given in the second cœtus to both corps is nearly the same, the questions for the *former part* of the examination are also the same.

Questions differ in *latter part*.

The students of the third cœtus, whose special studies differ according to their arm, have separate questions put to them. In those studies only where the instruction has been common are the questions the same.

It the examination for graphical representations, those drawings only are received which have been done by the students during their residence in the School, and are certified by the Professors.

Board of Examiners.

The examination is conducted by a Board, consisting of a President, five Members, and a Secretary, and bearing the title "Board for the Examination of Second Lieutenants of Artillery and Engineers" ("*Prüfungs-Kommission für Seconde-Lieutenants der Artillerie und des Ingenieur-Corps*").

Its nature.

The Board is immediately under the *Curatorium* of the Artillery and Engineer School; it has its own seal; it is quite independent of the other authorities of the School. The President is an Artillery or Engineer Officer of rank; the Members consist of three Artillery and two Engineer Officers of equal rank, as far as possible Field Officers, or at least of Captains of some standing, but not belonging to the *personnel* of the Artillery and Engineer School.

Appointed by the Curatorium.

The President and members are appointed by the *Curatorium*.

The Secretary.

The duty of Secretary is performed by one of the "Direction" Officers of the Artillery and Engineer School. He is appointed by the *Curatorium* upon the recommendation of the President, and cannot be changed as long as he belongs to the School, without the approval of the President.

Distribution of the examination among the members of the Board.

As a general rule, the Senior Officer of each of the Arms reports upon the examination papers relative to the special sciences of his arm in the *latter part* of the examination. The President distributes the other reports among the members as he thinks best, having regard, however, as much as possible, to their individual wishes.

Absence of a member.

In case of the absence of a member through duty, leave of absence, or illness, the President makes arrangements for his part being taken by another member, or, if necessary, applies for a new one to be appointed in his place.

In the absence of the President, the Senior Member takes his place.

Majority of votes decides.

The decisions of the Board are determined by a majority of voices. If the votes are equal, the side upon which the President has voted is considered that of the majority.

The expenses of the Board for stationery, copying, and printing are borne by the office-fund of the Artillery and Engineer School. The requisitions on this head are to be attended to by the Director of the School with the least possible delay. The *Curatorium* decides any disputed question.

Mode of the Examination.

The examination in both parts is written only. The number of questions given to each pupil is,— Examination written only.

Number of questions.

- 3 in Artillery
- 3 in Special Engineering
- 3 in Mathematics
- 2 in Physics
- 2 in Military History
- 2 in Surveying

} for the *former part* of the examination.

- 3 in Artillery (for the Artillery Students)
- 2 in Exclusive Engineering (for the Engineer Students)
- 2 in Hydraulic Construction (for the Engineer Students)
- 3 in Mathematics
- 2 in Chemistry

} for the *latter part* of the examination.

How drawn up.

The examination questions are drawn up by the Instructors in the different Sciences of the Artillery and Engineer School, and in so large a number that the Board is able to make a frequent selection. Still the Board is allowed, in cases where it considers it desirable, to draw up questions of its own.

Nature.

The questions must be confined to the course of instruction of the Cœtus to which the student belongs, must not omit any leading subject, and must as much as possible have a practical bearing. They must further be so clearly and distinctly expressed that no uncertainty can exist as to their purport, at least by such pupils as have such an acquaintance with the subject as careful attention to the course of the school would give.

Questions marked, and time required to answer them noted.

Further, to avoid all mistakes in the questions on Artillery, Fortification, and Mathematics, they must be marked to show for which of the two parts of the examination they are intended. Finally, every question, without exception, must have noted upon it the time which a pupil of ordinary ability would take to answer it.

Questions to be renewed.

The examination-questions, always carefully guarded, are, at the request of the Board, to be renewed, completed, and those which have become no longer suitable, to be withdrawn. When the Board has decided on a change, the President puts himself directly in communication with the individual Instructor, after having previously acquainted the Director of the Artillery and Engineer School. The Instructors are obliged to attend to such requests without delay.

Papers first examined by the teacher.

The answers are, in the first place, to be examined and noted by the Instructor of the Science to which they refer in the cœtus the student belongs to. All faults and mistakes, contrary to the principles taught in the School, are to be underlined, in order that the Reporting Members of the Board may not be left in doubt whether the faults are chargeable or not.

Copying from another student.

If the Examiner be convinced that a student has copied from his neighbour, or has made use of any other forbidden assistance, the lowest mark, or *censure*, is given for the work. Cases of this kind are specially reported by the Reporting Member of the Board to the President, who in doubtful cases brings them before a full meeting.

In awarding marks, conduct of student not to be considered.

The censure is awarded entirely for the amount of work done, without reference to the conduct of the young man while a student, or when with his regiment. The following scale of censure is employed. It is divided into nine parts, and has a numerical value placed opposite each term.

Scale of censure.

Excellent (*Vorzüglich*)	9
Very good (*Sehr gut*)	8
Good (*Gut*)	7
Sufficiently good (*Ziemlich gut*)	6
Satisfactory (*Befriedigend*)	5
Moderate (*Mittelmässig*)	4
Insufficient (*Nicht hinreichend*)	3
Rather unsatisfactory (*Fast ungenügend*)	2
Quite unsatisfactory (*Ganz-ungenügend*)	1

Papers examined afterwards by the appointed Member of the Board.

After the work has been examined by the Teacher in whose department it is, it is submitted to the Reporting Member of the Board, who gives it a most careful perusal, and, according to his own judgment, either adopts the censure of the

His marks alone weigh.

Teacher, or substitutes a censure of his own. In the latter case, the censure of the Member of the Board alone weighs in determining the result; the original censure is, however, given in the Forms B, C, and D, which accompany the Report.

Report on the Examination.

Report on the examination.

When the examination of the work is finished, the President of the Board assembles the members for the purpose of communicating the whole of the results, deciding upon them by the vote of the majority, and settling any doubtful points after hearing the Reporting Member in each case.

The decision of the majority is considered that of the whole of the Board.

Then follows the discourse of the President on the principal points to be introduced into the Report to the *Curatorium*, and on the proposals to be submitted to the latter upon the results of the examination, and finally a decision on all come to by vote.

The Board is not only permitted, but it is charged, to point out in its Report, any failings which the examination has brought to light, and in what regards the furtherance of the object of the examinations, to propose remedies.

The Report consists of two parts;—the first refers exclusively to the *former part* of the Special Corps Examination, and which can be only preliminary, as it has for its object—

1. To submit, for the decision of the *Curatorium*, the students considered fit to be promoted into the third cœtus of the School.
2. To point out for selection the students who appear qualified to enter the higher mathematical class of this cœtus.

The second Report, on the other hand, contains the results of the whole of the Special Corps Examination, and therefore includes the results of the *former part*, already given.

The ground of the first Report is the sum of the results as given in Form B., of which a copy is forwarded with the report to the General Inspector of each arm.

To the second or principal Report is joined the sum of the results as shown in Form C. for the Artillery, and in Form D. for the Engineers, and is also made out in duplicate.

Remarks for explanation are given where necessary in the Forms. The censures for the work are expressed in their numerical values.

Requirements of the examination.

A student is not considered to have passed a satisfactory examination unless he has obtained—

1, in the special studies of his arm,
2, in Mathematics,
3, also, in the total of the censures,

the middle point of the scale of censures, viz., "*satisfactory*," the numerical value of which is 5.

In the *former part*.

In the *former part* of the examination, every student must, therefore, according as he is an Artillerist or Engineer, obtain—

In Artillery or in Special Engineer Instruction - - - -	15
In Mathematics - - - - - - - -	15
Making in Special Arm Science the total of -	30
In the Ancillary Sciences—Special Engineer Instruction for an Artillerist, Artillery for an Engineer, 15; Natural Philosophy and Military History, each 10; thus, altogether - - - - -	35
In Drawing (Surveying) - - - - - -	10
Making a general total of - - - -	75

Requirements for entering the higher Mathematical Class.

In order to be selected for the higher mathematical class, the student must obtain at least the censure "*good*," to acquire which, he must have been awarded at least twenty-one marks in Mathematics.

Class restricted in number.

In order to prevent this class becoming too large, exceeding from twenty to thirty students, the requirements for entering it are raised.

A student must, in order to pass the *latter part* of the examination, obtain— In the *latter part.*

If an Artillerist,—	
In the Science of his Arm (Artillery) - - - - - -	30
In Mathematics - - - - - - -	30
Total in Special Arm Science - - -	60
In the Ancillary Sciences—Fortification, 15; Natural Philosophy, 10; Chemistry, 10; Military History, 10; altogether - - -	45
In Drawing—Surveying, 10; Plan Drawing, 5; Artillery Drawing, 5; altogether - - - - - - - - -	20
Making a total of - - - -	125
If an Engineer,	
In special and exclusive Engineer Science - - -	25
In Hydraulic constructions - - - - -	10
Thus, in the Science of his Arm - - - - -	35
In Mathematics - - - - - - -	30
Total in Special Arm Science - - -	65
In the Ancillary Sciences—Artillery, 15; Natural Philosophy, 10; Chemistry, 10; Military History, 10; altogether - - -	45
In Drawing—Surveying, 10; Plan Drawing, 5; Fortification Drawing 5; Architectural Drawing, 5; altogether - - -	25
Making a total of - - - -	135

A compensation between a shortcoming in one science and an overplus in another is only permitted in *both* parts of the examinations in the Ancillary Sciences, and between them and the Drawing. In the Special Arm Sciences such a compensation is not only not allowed, but the mean censure "*satisfactory*" must be obtained for *each* of the subjects. On the other hand, any excess of censure in the Special Arm Sciences goes to make up for deficiency in the Ancillary Sciences or in the Drawing. Distribution of marks.

No abatement in the above-mentioned requirements can take place, except by the direct decision of the *Curatorium* in exceptional cases.

In order to guard against any of the students neglecting altogether single subsidiary sciences, the Commission is empowered to propose to the *Curatorium*, as having failed, students who have not obtained at least the mean censure "*insufficient*" in such a science, even when they have fulfilled the conditions demanded for the examination. Mode of preventing a science being altogether neglected.

Allusion is here specially made to such sciences as in the future profession of student must be considered of importance, as Fortification for the Artillerist, Surveying and Drawing for the Engineer.

The final decision upon the result of the whole of the examination will be obtained by dividing the sum of the censure values by the number of questions given in both parts of the examination. The subjects in the different branches of Drawing will be considered each as one question. The division will, in consequence, be for the Artillerists, 25; for the Engineers, 27. Should, for example, an Artillerist have obtained 125 marks, his final censure would be $\frac{125}{25} = 5 =$ *satisfactory;* and he would be considered successful if the requirements above detailed were satisfied in other respects. Final result.

An Engineer would require, in an analogous case, to obtain 135 marks, in order to win the final censure "*satisfactory.*"

In making the division, all fractions less than one-half are not taken notice of; if they exceed one-half, the next highest integral is taken as the quotient.

There is an exception to this rule in so far as regards the censure "*satisfactory,*" for which the complete numerical value (125, 135) must be obtained, except the *Curatorium* should, in a special case, decide otherwise.

The above rule is also followed in determining the mean censure in the different subjects of examination, given in the certificate of qualification.

Still, however, this rule applies only, in both cases, to the *verbal expression* of the censure. The numerical value of the mean censure given in the Forms C and D remains unaltered, *i.e.*, the quotient is given exactly as it results from the division, fractions included.

The order of seniority of the Students for Commissions is stated in figures in the last column of the Form C or D.

Mode of determining the seniority of Officers.

The order of standing is determined in the first instance by the date of nomination to the rank of Officer. It is only for those Officers whose nomination took place on the same day, that the result of the examination is had recourse to. In doing this the rule is, that in the different classifications, *i.e.*, in arranging the students who have received the same general censure, those who have fulfilled all the conditions above given shall be placed first in the order of their totals. After them follow, arranged in the same way among themselves, those alluded to as having obtained the requisite mean censure, and the censure in Special Arm science, but a low censure in the subsidiary sciences; next come those who have received sufficient marks in the Special Arm sciences, but whose total does not reach the prescribed minimum; then those who have reached the minimum, but have failed in the Special Arm sciences; finally, those who have failed altogether.

Should exact equality happen in any of these groups, the order of rank is to be decided, first, by the date of nomination to Ensign, then the date of entry into the service, and finally the date of birth.

Certificates of qualification.

After the decision of the *Curatorium* has been given upon the principal Report of the Board of Examination, the latter proceeds to make out the certificates of qualification, according to form E, for the successful students. These certificates are forwarded, in the case of Artillerists, to the General Inspector of Artillery; in the case of Engineers, to the General Inspector of the Engineer-Corps.

Abstract of examination sent to General Inspector of Military Education.

A copy of the tabular statements C and D, together with a copy of the decision of the *Curatorium*, is forwarded to the Inspector of the Artillery and Engineer School. An abstract of the principal features of the examination of the Students permitted to undergo the *latter part* of the examination, is forwarded, through the General Inspector of each arm, to the Inspector-General of Military Education (*General Inspection des Militair-Erziehungs und-Bildungs-wesens*).

Certificates of departure are made out by the Director of the School for the Students who have failed in the examinations, and are delivered to them by their Corps.

Students who have been unsuccessful.

Students who have been declared unsuccessful by the decision of the *Curatorium*, can by distinguished conduct and application in their regiments, in so far as they have not been allowed a further attendance in the Artillery and Engineer School, be permitted to present themselves again for examination. In this case it is, however, the rule that the whole of the part in question of the examination is gone through, unless the General Inspector thinks a departure from the rule justified, and specially desires it.

A restriction of the examination to those subjects, in which the Student formerly failed, is, however, only permitted in the case of exemplary conduct, and very high qualifications for the practical duties of the service.

Portions of Report of Examiners communicated to authorities of the School.

The decision of the *Curatorium* upon the Report on the *former part* of the Special Corps Examination, is communicated directly to the authorities of the School, so far as it refers to the Students considered qualified to be advanced into the third cœtus. As, however, it is in the interest of the Artillery and Engineer School that the authorities of it should be acquainted with the more immediate details of the examination, (the knowledge of the result of the mathematical examination is indeed indispensable, as upon it depends the division of the Students into the two mathematical classes of the the third cœtus,) a copy of the tabular statement B is forwarded with the least possible delay to the Inspector of the School by the Board of Examination.

Preparations for the Examination.

Preparations for the examination.

As soon as the Board of Studies of the Artillery and Engineer School has determined what students are qualified to present themselves for examination, the same is communicated to the Board of Examination. The list for the students of the third cœtus is made out in the Form A.

In this list the students of the two Corps are arranged separately, and by regiments or divisions. The information given in the last four columns is intended to aid the Commission in making out the order of rank. It is not required in the list of the students of the second cœtus.

Any alterations which the *Curatorium* may decide upon, on the proposition of the Board of Studies, are given in a supplementary communication by the latter to the Board of Examination.

For candidates who do not come from the School, but who have had the permission of their General Inspector to present themselves from their regiments, these lists are forwarded to the Board through the General Inspectors. Instead of the School censure, which is necessarily wanting in these cases, an entry is made in the list of the conduct and diligence of the candidate while with his regiment.

Selection of questions by the Members of the Board.

When the collections of questions are complete, the President of the Examination Board divides them among the Members, in order that each may select for the portion of the examination committed to him the required number of questions.

In order to prevent the same questions being given in different years frequently in succession, each Member marks on the margin of the questions selected the date of the year.

Selection of questions approved of at a full meeting.

As soon as the selected questions have been approved of in a full meeting of the Board summoned to consider the point, they are then sealed, and taken in charge of by the President until the time of the examination.

Details of examination arranged.

At this meeting the days of the examination, and the subjects on those days, are to be arranged, as well as the routine of attendance of the Members during the examination. As regards the latter point, it is the rule that all other duties which may devolve upon the Members are to give place to studies of the Board.

Officers detailed to oversee candidates under examination.

To assist the Examiners in overseeing the candidates while the examination is going on, a Captain of the Artillery Regiment of the Guard is detailed each day of the examination, and, if requested, also one or two of the Military Instructors of the School.

The demands for the attendance of these Officers are forwarded by the President of the Board of Examination; if for the Captain of the Artillery of the Guard, to the General Inspector of the Artillery; if for a Military Instructor, to the Director of the Artillery and Engineer School. In both cases these demands are to be accompanied by a tabular statement, showing the subjects of examination for each day, the examination room for each division, the name of the Member of the Board of Examination on duty each day, and the hour of commencement.

A similar table is sent to the General Inspector of the Engineer Corps.

The President of the Board, and the Director of the School, arrange beforehand the days of the examination and the disposal of the rooms.

The names of the Officers from the School and from the Artillery of the Guard, detailed for each day to oversee the candidates, is notified beforehand to the President.

Directions for Conducting the Examinations.

Mode of conducting the examination.

On the days of examination the Secretary of the Board assembles the candidates in the examination room half an hour before the commencement of the examination; previously to which he takes care that the Member of the Board, and the Officers detailed to aid him, have each received a place-list of the candidates. In this list is shown the arrangement of the candidates at the tables, the Artillerists in the order of their Regiments, the Engineers in that of their Divisions, so that the name of any candidate can be known at once by means of the place-list, without its being necessary to inquire it. To prevent mistakes, the names of the Engineers are entered in red ink, and the extraordinary candidates, *i.e.*, those who do not belong to the Artillery and Engineers School, are placed last.

Candidates provide their own stationery.

Each candidate provides himself with the necessary stationery.

Warned against using forbidden assistance.

As soon as the candidates have assembled and taken their places, and the Member on duty of the Board has arrived, the former are expressly warned against the use of forbidden assistance, against speaking to or copying from their neighbours. They are reminded that by a decision of the *Curatorium*, bearing date June 27, 1836, any one in whose possession any epitome, notices, books, manuals, or extracts from them shall be found, shall, without exception, be sent away from the examination, no regard being had to whether he has made use of these helps or not; that further, the same course will be taken with those who are detected copying from a neighbour or conversing with him.

Finally, they are informed that, in all cases where it appears on examining the papers, and so retrospectively, that a candidate has copied from books, manuals, or his neighbour, his work will be marked with the lowest censure, namely, "*quite unsatisfactory.*"

Candidates retire for a few minutes.

After this warning, the candidates are dismissed for a few minutes, with the advice that if they have any forbidden helps in their possession, to lay them aside before their return to the examination room.

Re-assemble.

When the candidates are again assembled, the Secretary delivers to the Member on duty of the Board, or to the Officer detailed to assist in case he should be the senior, the sealed packet of questions. The seal is then broken, and the first question dictated, the time within which the question is to be answered being given. The candidates are desired further to write distinctly their name, rank, and regiment, and the date at the top of the sheet; to fold the sheet lengthways in half, and to write the question on the left side and the solution on the right; to write clearly and legibly. The second question is not given until the papers of all the candidates have been given in, and the candidates have assembled again in the examination room.

Time of questions limited.

Papers which are not finished at the expiration of the given time must be given in unfinished.

Irregularities of candidates.

The Member of the Board of Examination, and the Officers detailed to aid, take the most careful precautions to prevent any of the irregularities specified above being committed. Should, however, they occur, the offender is immediately sent out, and the circumstance brought to the notice of the President, who refers it to the *Curatorium*.

Papers marked with time taken to write them.

As the papers are delivered in, the Member of the Board, or the Officer detailed, marks on them the time occupied in the work, and appends his signature.

Papers forwarded to teachers.

The papers are then collected by the Secretary, and forwarded sealed to the Instructor whose duty it is to examine and give them the first censure.

Besides the place-list, a nominal roll of the candidates, according to Form F, is forwarded to the Instructor, in which he enters under each question the "censure" which he thinks it deserves. On the paper the censure is expressed in words, but in the list by its numerical value.

Papers must be examined without delay.

The instructors are charged to undertake the examination of the papers without delay; in no case must they take more than fourteen days from the date of reception. They must in consequence mark the papers with the date of reception and sending back.

Papers then sent to reporting Members of the Board.

When the papers have been returned to the President of the Board, they are given over by him to the member who is to report upon them. The latter then proceeds to his task, and gives his censure upon each question in the same mode as the Instructor has done, using, however, a different coloured ink.

The Member of the Board must complete his examination with the least possible delay, in order that the closing of the examination and the preparation of the Report upon it may not be delayed.

Marks for drawing.

To fix the censure for drawing, the President assembles the Board and lays before the Members the various Plan, Artillery, Fortification, and Architectural Drawings which the candidates have executed during their course at the school, together with the censures which the Instructors have awarded to them. The decision of the Board is immediately entered in the list (Form E.)

The censure for drawing takes place only for the *latter part* of the Examination; it is not required for the *former part*.

From the censure-list made out as above, and from the list according to Form A, the Table B. for the *former part*, and the Tables C and D for the whole of the examination, are made out.

Examination in Surveying.

As has been already remarked, the *former part* of the examination cannot be closed until after the examination in surveying, which is regulated by the closing of the geodetical operations of the second cœtus. This period is arranged between the President of the Board and the Director of the School, and the time of the examination so fixed that the examination may take place immediately after the end of the practical exercises.

Candidates prevented from taking part in examination in surveying.

Such candidates for admission into the third cœtus as have been prevented by causes beyond their control from taking part in the examination in Surveying, may be permitted, exceptionally, by the *Curatorium* to proceed into the third cœtus on the understanding that they undergo their examination the following year.

TABLES referred to in the REGULATIONS for the SPECIAL-CORPS EXAMINATION of SECOND LIEUTENANTS of the ARTILLERY and of the ENGINEER CORPS.

FORM A.

Corps.	Christian Name and Sirname.	General School Censure.			Date of Nomination to the rank of Officer.	Date of Patent of Ensign.	Date of Entrance into the Service.	Date of Birth.
		Ability.	Diligence.	Conduct.				

REMARKS.

In the column of "Date of Entrance into the Service:"

1. For such candidates as entered before the completion of their 17th year, the date of their 18th birthday is to be the date given, as any previous service does not count.
2. For such candidates as came from the Cadetten-house, the date of the Cabinet Order upon which they were assigned to their Corps, is the date to be given. Should, however, the Candidate not have completed his 17th year at the date of the Order, the Rule (1) is to apply.

FORM B.—FOR ARTILLERY.

	Regiment.	Names.	Special-Arm Sciences.			Ancillary Sciences.				13 × 5 65		15 × 5 75	Remarks.
			3 × 5 15	3 × 5 15	6 × 5 30	3 × 5 15	2 × 5 10	2 × 5 10	7 × 5 35				
			Artillery.	Mathematics.	Total.	Special Engineering.	Natural Philosophy.	Military History.	Total.	Total of Sciences.	Surveying.	Grand Total.	
1	Guard -	N. N. -	14	16	30	17	9	9	35	65	10	75	
2	„	N. N. -	14	20	34	16	8	11	35	69	10	79	

FORM B.—FOR ENGINEERS.

No.	Engineer Inspection.	Names.	Special-Arm Sciences.			Ancillary Sciences.					2 × 5 10		Remarks.
			3 × 5 15	3 × 5 15		3 × 5 15	2 × 5 10	2 × 5 10					
			Special Engineering.	Mathematics.	Total.	Artillery.	Natural Philosophy.	Military History.	Total.	Total of Sciences.	Surveying.	Grand Total.	
1	1	N. N. -	17	14	31	15	11	9	35	66	10	76	
2	1	N. N. -	16	15	31	14	10	11	35	66	9	75	

Form C.—Artillery.

No.	Regiment of Artillery.	Names.	Special-Arm Sciences.				Ancillary Sciences.						Drawing.					General School Censure.			General result of the Examination.	Data for Classification.				Order of Classification.
			6 × 5 30	6 × 5 30		12 × 5 60	3 × 5 15	2 × 5 10	2 × 5 10	2 × 5 10	9 × 5 45	21 × 5 105	2 × 5 10	5	5	4 × 5 20	25 × 5 125					Date of Nomination to the Rank of Officer.	Date of Patent of Ensign.	Date of Entrance into the Service.	Date of Birth.	
			Artillery.	Mathematics. Lower.	Mathematics. Higher.	Total.	Special Engineering.	Natural Philosophy.	Chemistry.	Military History.	Total.	Total of Sciences.	Surveying.	Artillery Drawing.	Plan Drawing.	Total.	Grand Total.	Ability.	Diligence.	Conduct.						
1	2nd -	N. N. -	VII. 36 36 6	VIII. 39 39 $6\frac{3}{6}$		75 75 $6\frac{3}{12}$	VII. 19 19 6	VIII. 15 14 7	VI. 12 12 6	VI. 15 15 $7\frac{1}{2}$	61 60 $6\frac{9}{12}$	136 135 $6\frac{2}{25}$	V. 9 $4\frac{1}{2}$	V. 5 5	IV. 4 3	18 17 $4\frac{1}{4}$	154 152 $6\frac{2}{25}$	Good.	Pretty Good.	Good.	Good	—	—	May 1, 1849	Apr. 18 1832	17

Remarks.

1. The Roman figures denote the last School censure, taken from Form F.
2. The figures in red denote the sum of the numerical values of the censures given, for each subject, by the Instructor of the Artillery and Engineers School to whom the examination papers have been referred.
3. The following line of figures in black denote the sum of the numerical values of the censures, given in the same way, by the Member of the Board of Examination.
4. The last line of figures gives the mean of the numerical values of the latter censures.

N.B.—The above remarks are to be repeated, in every case, upon the outside of the fair copy of the list sent to the *Curatorium*.

Form D.—Engineers.

No.	Engineer Inspection.	Names.	Special-Arm Sciences.					Ancillary Sciences.						Drawing.						General School Censure.			General result of Examination.	Data for Classification.				Order of Classification.
			5 × 5 25	2 × 5 10	7 × 5 35	6 × 5 30		3 × 5 15	2 × 5 10	2 × 5 10	2 × 5 10	9 × 5 45	22 × 5 110	2 × 5 10	5	5	5	5 × 5 25	27 × 5 135					Date of Nomination to Rank of Officer.	Date of Patent of Ensign.	Date of Entrance into the Service.	Date of Birth.	
			Special and exclusive Engineering.	Hydraulic Constructions.	Total of Engineer Sciences.	Mathematics. Lower.	Mathematics. Higher.	Total.	Artillery.	Natural Philosophy.	Chemistry.	Military History.	Total.	Total of Sciences.	Surveying.	Plan Drawing.	Fortification Drawing.	Architectural Drawing.	Total.	Grand Total.	Ability.	Diligence.	Conduct.						

Remarks.—The remarks given in Form C apply equally to the present Form.

Form E.

Second Lieutenant, N.N. of the { ———th Regiment of Artillery, / Engineer Corps,

has in the Special-Corps Examination held in the years 18— and 18— given proof of acquirements—

Officer of Artillery.		*Officer of Engineer Corps.*
1. In Artillery - -	- Good.	1. In Special and Exclusive Engineering.
2. „ Mathematics -	-	2. „ Hydraulic Constructions.
3. „ Special Engineering	-	3. „ Artillery.
4. „ Natural Philosophy	-	4. „ Mathematics.
5. „ Chemistry - -	-	5. „ Natural Philosophy.
6. „ Military History -	-	6. „ Chemistry.
7. „ Surveying -	-	7. „ Military History.
8. „ Artillery Drawing -	-	8. „ Surveying.
9. „ Plain Drawing -	-	9. „ Plan Drawing.
		10. „ Fortification Drawing.
		11. „ Architectural Drawing.

The mean or average of the whole of which being , he has in consequence passed successfully, whereupon the present Certificate has been executed by the undersigned Board.

Board of Examination for Second Lieutenants of Artillery and of the Engineer Corps.

Stamp.

Signatures of President and Members.

Below on the left hand.

Certificate of Qualification as Officer of { Artillery / Engineer Corps, } of Second Lieutenant (Christian name and Surname) of { the Regiment of Artillery. / Engineer Inspection.

Below on the right hand.

Signature of the Secretary of the Board.

Form F.

Corps.	Rank.	No.	Names.	Extract from the last Censure-book.	Judgment of the Instructor on the Questions.			Remarks of the Member of the Examination Board.		
					I.	II.	III.	I.	II.	III.

GENERAL REMARKS ON PRUSSIAN MILITARY EDUCATION.

The double examination the principle of Prussian education.

1. Attention has often been drawn to the peculiar feature of Prussian Military Education, the double examination for the rank of Officer. The principle adopted seems to be the exaction of a proof from *all* officers that they have received a good, general, and professional education, rather than the selection of a smaller number for higher training in a military school. The decree of 1808 first laid down the rule for the whole army, "that the only title to an Officer's commission shall be, in a time of peace, education and professional knowledge,—in time of war, distinguished valour and ability."

Emulation only moderately called forth.

2. The spirit of emulation is not so much called out in Prussia as it is in France. Early distinctions are acknowledged and appealed to, but somewhat sparingly. The following words express the view taken on this point: "A testimonial of fitness for the University," says Colonel von Holleben, (*i.e.*, to have passed the Abiturient examination) "dispenses with the examination for the ensingcy. In consequence of this rule fifty *Abiturients* on an average annually enter the army. These, as well as the *Selectaner* of the Cadet Corps, must be considered in point of scientific education, an excellent supply of officers."

Inadequacy of the rewards.

3. It will be seen that in the above words there is no reference to those rewards and advantages which are the stimulus of competition. There appears some want in this respect both in the earlier and later training of Officers. Thus, in the instance of the Cadet House, there are numerous *free places*, but these are assigned to young men, not from any proof of merit or exertion, but entirely because they are the sons of Officers or State Servants. The most distinguished pupils, the *Selectaner* gain nothing more than to be permitted to pass these two examinations before, instead of after, entering the army. Honourable mention is, however, made of the candidates for commission who distinguish themselves in the Division Schools. But in the Staff School—the natural resource of energetic young Officers—the competition (which the school asserts as its principle by its entrance examination) loses some of its force, by the order of the pupils on leaving the school not being distinctly marked. It should be mentioned as an explanation of these facts, that in the general Civil Education of Prussia, competition is little encouraged, less than in our own, and far less than in the French, or even in the Austrian Education.

4. The military system of Prussia, and in some degree its military education also, appear to have various objects in view. Thus the Cadet Houses, where the free places are chiefly given to the sons of military men, seem intended to keep up a military *esprit de corps*, and it is impossible not to be struck by the strong class spirit prevailing in the Prussian army. At the same time means are taken, as above stated, to obtain a good supply of highly educated Officers.

Improvements in Prussian Military Education.

Division Schools.

5. Prussian Military Education seems to have been constantly correcting and extending itself. Of this the Division Schools are a striking example; and they deserve attention, both because their plan is peculiar to Prussia, and for the improvements they have received. The Prussians at first established numerous Division Schools, but they afterwards greatly diminished their number; and the General Inspector of Military Education now contemplates, both for the sake of the Instructors and their Pupils, a further reduction to three or four. A large military school in three or four towns in Prussia, intended to teach professional knowledge to young officers after some short practical experience in the Army, is thought a better mode of giving such knowledge than to place isolated, or few teachers, in Regiments or Army Divisions.

Importance of placing Military Education under a single head.

6. One chief means of improvement has been the bringing the whole Education under a single head. At first there were distinct Boards for the examinations in Prussia, and for the schools, with a view to maintain the independence of each. It was found, however, that this led to a want of harmony between the schools and the examinations; and accordingly, whilst the Board of Examiners and the School Professors are kept perfectly distinct, they are both subjected to the General Inspector, who controls all the departments of Military Education. The effect of this has been to give more unity to all the teaching;

an essential point where that teaching is entirely on the same subjects. By constant inspection of the schools, and the receipt of periodical reports from them, the General Inspector of Military Education is able to compare the results of each, and to keep the whole system going at an even rate of progress.

7. Attention should be drawn to the somewhat complicated system for working the Military Schools in Prussia. There are two distinct Boards, as we have noticed above, the Supreme Board of Studies and the Examinations Board, one of which reports to the Inspector-General on all examinations, whilst the other acts as his assessors and advisers with regard to the schools and on all other subjects of Military Education. Besides these bodies, each School has its own Board of Studies, which is generally formed by some one person belonging to the school, combined with distinguished Officers or Professors. Suggestions with regard to each school appear to originate chiefly from these latter bodies.

General Inspector.

8. The Department of Military Examinations and Education is under the control of the General Inspector, who "lays his proposals on matters of administration before the Minister of War, but reports directly to the King in all matters relating to instruction and examinations."

Colonel Von Holleben's Evidence.

List of works and documents consulted

A VERY complete account of the Prussian Military System is contained in Helldorf's Dienst-Vorschriften der Königlich-Preussischen Armee, Berlin, 1856. In this work will be found all that is most important in the printed official accounts of the various institutions; for example that of the Cadet Schools (Bestimmungen der Aufnahme in das Cadetten-Corps), and the documents relating to the Artillery and Engineer Schools, a translation of which has been given, p. 134.

A list of other papers, as supplied by Col. Von Holleben, is given in page 133; and a complete account of the Text Books used in the Schools has been furnished in a letter from Lieutenant Berger, placed in the Appendix.

The History of the War School, by Friedländer, contains much valuable information.

Articles in the Appendix.

The following subjects, closely connected with Prussian Military Education, will be found in the Appendix:—

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AUSTRIA.

AUSTRIA.

Service of Austrian Soldiers.

The Austrian Army is recruited by conscription, the period of service being for eight years, with two years in addition for the reserve; but such soldiers as wish it may generally obtain leave after six years' service. Those who serve eight years are understood to have a claim for employment on railways and in the custom-houses. Substitutes are allowed, but they are solely provided by the State, and the means used for supplying them is made an element towards securing good Non-Commissioned Officers for the Austrian Army in the following manner.

The sum paid over by private individuals for avoiding service in the Army is £150 (1,500 florins), and the Government, in providing a substitute, pay him the *interest* of this sum during his period of service, and the *capital* when it is completed. A good substitute is permitted to serve twice, and he may thus receive £300 (3,000 florins) when he quits the Army. Generally speaking, the substitutes provided by the Government are good Non-Commissioned Officers, who by these means are induced to continue a length of time in the service.

Officers.

The Officers are obtained during a state of peace, either from the Military Academies, or by direct entry as Cadets, after passing a slight examination,* into the regiments of infantry and cavalry, in which capacity they perform the ordinary duties of soldiers, and no particular period of service is required in this grade. The entry as Cadets is by nomination, part by the Colonels, proprietors of Regiments; part consisting of those having claims on the Regiments; and part of those recommended from the ranks.

Those who join the Army from the Military Academies consist principally of the sons of military men, whose education is mainly provided for by the State, and of others who are placed there by means of funds provided by provinces, districts, municipalities, or private individuals.

Any Austrian subject has a *claim* for admittance, on payment of the annual sum prescribed by the regulations.

There is no fixed proportion existing between the Infantry and Cavalry Officers supplied from the Military Academies, and those entering regiments directly as Cadets, but it is understood that the former do not amount to more than one-twentieth or one-thirtieth of the latter.

The Artillery and Engineers are now entirely supplied with Officers from the Military Academies.

There is no difference in the pay of Officers of the same rank in the various Arms in Austria.

Officers when not required are placed on half-pay, which is rather less than the half of their actual pay whilst serving. When an Officer dies, his widow is not entitled to a pension, but the State provides for the education of the children; and to prevent distress, an Officer is not permitted to marry unless he has a certain income, independent of his pay, for the maintenance of his wife.

Promotion.

The promotion in the Infantry and Cavalry is Regimental, and usually by seniority; but there is no doubt that promotion by selection also takes place, though not in the Regiment itself, the Officer selected being promoted into another Regiment. The promotion in the Artillery and Engineers is also by seniority, and by Corps, and, until the Hungarian war, was exceedingly slow.

Purchase.

Although not actually sanctioned by the authorities, cases have occurred in the Austrian service where Officers have purchased steps from others serving in *different* regiments to themselves in the following manner:—If any Officer is about to retire from the service, the promotion in the regiment being by seniority, the Officer whose turn it would be to obtain the promotion would frequently sell his right to a junior Officer serving in another regiment, who would thus be promoted into the vacancy. We were informed that this system had formerly led to frequent duels between the Officer obtaining the promotion, and those Officers in the Regiment whose prospects were directly injured, by the senior having sold his promotion, and thus stopped their advancement.

Military Education.

Military education in Austria has been entirely remodelled since the Hungarian War, and is now conducted in a very regular and systematic manner

* The particulars of the examination for admission as a Cadet into a Regiment will be found in a separate Article, p. 194.

under the sole control and supervision of the Fourth Section of the Supreme War Department, entitled "Military Schools."

Department of Military Education.

The whole of the arrangements, and the establishment of this Fourth Section for Military Education, are understood to have been recommended to the Emperor by Lieut.-General Coronini, at present commanding the Austrian Forces in the Principalities.

The Chief of this Section is the Lieut.-General Gorizutti, and the Second in Command is Colonel Scudier.

The establishment consists besides of—

2 Majors of Infantry.
1 Captain of Artillery.
2 Captain of Infantry.
2 Lieutenants of Infantry.
2 Employés belonging to the Administration.
6 Clerks.
6 Messengers.

Expenditure on Military Education, independent of Foundations by Provinces, Districts, and Private Individuals.

To show the great importance of the Fourth Section, it will only be necessary to state that the disbursements of the Government for Military Education in Austria for the current year are estimated at 281,440*l.* (2,814,400 florins), without taking into consideration the sums contributed for foundations by Provinces, Districts, and Private individuals, or of those received for the education of paying Students. This sum of 2,814,400 florins is apportioned in the following manner:—

	Florins.*	No. of Students.
Vienna Staff School - - - - -	43,000	30 Officers.
ACADEMIES—		
Wiener Neustadt, for Infantry and Cavalry - -	256,000	400 Students.
†Znaim, Engineers - - -	157,000	200
Olmutz, Artillery - - -	122,000	200
Trieste, Marine - - -	73,000	100
4 Cadet Houses at 87,000f. - - - -	348,000	800
SCHOOL COMPANIES—		
6 Infantry at 33,000f. - - - -	198,000	720
‡1 Cavalry „ 39,000f. - - - -	39,000	60
2 Frontier „ 35,000f. - - - -	70,000	240
SCIENTIFIC SCHOOL COMPANIES—		
5 Artillery at 35,000f. - - - -	175,000	600
1 Engineer „ 36,000f. - - - -	36,000	120
1 Pioneer „ 36,000f. - - - -	36,000	120
1 Flotilla „ 22,000f. - - - -	22,000	60
1 Marine „ 40,000f. - - - -	40,000	150
1 NON-COMMISSIONED OFFICERS' or TEACHERS' SCHOOL, WIENER NEUSTADT.	17,000	60
12 UPPER HOUSES OF EDUCATION at 49,500f. - -	594,000	2,400
12 UNDER HOUSES „ 25,700f. - -	308,400	1,200
	2,534,400	7,430
Bureau of the 4th Section - - - -	280,000	
Total - - - -	2,814,400 =	£281,440 §

So that the annual cost to the State for the education of an Officer Student, Cadet, Non-Commissioned Officer, and Boy in these various Schools is as follows:—

	£	*s.*	*d.*
Student Officer at the Staff School - -	143	6	0
Student at the Engineer Academy - -	78	10	0
„ „ Artillery Academy - -	61	0	0
„ „ Infantry and Cavalry Academy -	64	0	0
„ „ Marine Academy - - -	48	6	0
Cadets at the four Cadet Houses - - -	43	10	0

* A florin is equal to two shillings of English money.

† The cost is probably augmented by the Provisional Course of Higher Instruction already in operation for the Officers of Engineers at Znaim.

‡ Only one Cavalry School Company has as yet been provided for.

§ We are indebted to the kindness of Lieutenant-General Gorizutti for this information.

School Companies—	£	s.	d.
An Infantry School Company Student - -	27	10	0
A Cavalry „ „ „ - -	65	0	0
A Frontier „ „ „ - -	29	4	0
An Artillery „ „ „ - -	29	4	0
An Engineer „ „ „ - -	30	0	0
A Pioneer „ „ „ - -	30	0	0
A Flotilla „ „ „ - -	36	12	0
A Marine „ „ „ - -	26	12	0
A Non-Commissioned Officer at the Teachers' School	28	6	0
A Boy at the Upper Houses of Education - -	29	14	0
„ Lower „ „ - -	25	14	0

And thus, as the course of instruction is continued for four years in the Cadet Houses, four years in the Academies, and two years in the Staff School, the cost of training the Officers in the Austrian Army is—

	£
For an Officer of Artillery, about - - -	420
„ „ Engineers - - - -	490*
„ „ Infantry or Cavalry - - -	430†
„ „ Marine - - - - -	370†
„ „ the Staff - - - - -	710†

Control of the Fourth Section over Education, of 1. Officers, 2. Non-Commissioned Officers.

From the Bureau of this Section at Vienna all orders for the management, maintenance, discipline, studies, and regulation of the various Schools and Academies are issued; and all details relating to the progress of the several students and the results of their examinations are periodically sent and regularly examined.

Military Education in Austria is divided into two main branches:—

1st. That intended for the education and training of Officers.
2d. That designed for the instruction and training of Non-commissioned Officers and Soldiers.

The first is specially provided for by the establishment of Cadet Houses, Academies, the Staff School at Vienna, and the Higher Courses of instruction for the Artillery and Engineers; and the second is carried on by means of Lower and Upper Houses of Education, and School Companies for the different services; and, as it will be somewhat more convenient, we shall commence our enumeration of the Austrian Schools with the latter.

On the Instruction and Training of Non-commissioned Officers and Soldiers.

1. Pupils in the Lower Houses of Education proceed to—

There are twelve Lower Houses of Education, each containing 100 pupils, who enter as soon as they have completed their seventh year, and remain for four years. They are almost entirely the sons of military, or quasi military men, and principally of Non-commissioned Officers and Soldiers; they hold what are termed military places, the whole cost of which is borne by the State: 300 pupils enter and quit these houses at the end of each school year.

the Upper Houses of Education.

The 300 leaving the Lower Houses of Education proceed to twelve Upper Houses of Education, each of which contains 200 pupils, making 2,400 altogether;‡ 50 enter and 50 quit each of these Upper Houses at the close of the school year. Of the 50 that enter, one half are received from the Lower Houses of Education, and the other half, after passing an examination equivalent to that undergone by the pupils leaving the Lower houses, are obtained from the various public and private places of education, or from their own homes. The age for admission is eleven, and the boys remain four years. Of the 2,400 pupils, 1,800 hold military or free places, and the remainder are maintained by exhibitions provided by the various provinces and private individuals, or at the expense of their friends.

Large number of free Places.

* This amount is probably in excess of the actual cost, as it may include the cost of the Higher Instruction to the Officers of Engineers at Znaim.

† These sums apply only to such Officers as are educated at Wiener Neustadt.

‡ Two or three of the most promising boys leaving each of the Under Houses may be sent direct to the Cadet Institutes to be educated as Officers.

Entry into the School Companies.

It is intended, as soon as the full numbers can be obtained, that 600 pupils belonging to the twelve Upper Houses of Education should annually leave at the end of the school year, to join the various School Companies which are in process of being organized for the instruction of the Non-commissioned Officers and Soldiers; but the whole of the School Companies are not yet established, and the number of pupils leaving does not yet amount to 600.

During the last year the number of students passed on from the Upper Houses of Education to the various School Companies* was as follows:—

To the 6 Infantry School Companies	-	322 Students.
„ 2 Frontier „ „	-	38 „
„ 4 Artillery „ „	-	60 „
(In the 5th Artillery School Company there were only men already in the service, Attendant Pupils or *frequentanten*.)		
„ 1 Engineer School Company	-	16 „
„ 1 Pioneer „ „	-	24 „
„ 1 Flotilla „ „	-	4 „
„ 1 Marine „ „	-	12 „
Total	-	476 „

Promotion from the School Companies.

The pupils who enter the Infantry and Cavalry School Companies only remain two years, and then join Regiments of Infantry and Cavalry, as Non-commissioned Officers (Corporals or Lance-Corporals) or Soldiers; but those intended for the other services remain three years, the instruction during the last year for the Artillery, Engineer, Pioneer, and Flotilla services being mainly practical.

Age for Admission.

The age for admission to the School Companies is 15, and the pupils are partly obtained from the Upper Houses of Education, partly from private places of Education, and partly from the Soldiers of the Standing Army as regards the Artillery, Engineers, Pioneers, and Flotilla and Marine School Companies; but to be admissible they must have passed through the Regimental Schools with credit, and not have served more than two years or be above the rank of an Upper Cannoneer, an Exempt, or an Upper Pioneer. These are called *Frequentanten* or Attendant Scholars.

Transfer of the most talented Pupils to the Academies.

About five or six of the most talented Pupils in each of the Artillery Engineer, Pioneer, Flotilla, and Marine School Companies are allowed to pass at the close of their second year's course of instruction, at 17 years of age, into the Academies for supplying these services with Officers: those intended for the Flotilla and Marine Services join the Artillery Academy, whilst those intended for the Pioneers are sent to the Engineer Academy. This advancement cannot fail to exercise an important effect in stimulating all the Pupils in these School Companies to exert themselves, and may possibly also react upon the mass of the Students who have come from the Cadet Institutes, and may cause them to use increased exertions towards maintaining their positions in the order of merit in the various classes against their competitors from the School Companies, who on the average are two years older than themselves.

On the Education and Training of Officers.

2. Course of a Pupil through a Cadet House,

This is provided for, to the extent deemed necessary by the Government, by means of Cadet Houses, which Students enter at 11 years of age and quit at 15, for the Academies, where they remain till 19.

There are four Cadet Houses, each containing 200 Students; and of the 200 that annually leave these Houses, 100 are intended for the Infantry and Cavalry Academy at Wiener Neustadt, 50 for the Artillery Academy at Olmütz, and 50 for the Engineer Academy at Znaim.

into an Academy, and promotion from thence.

At the present time there are four Academies, viz.: that at Wiener Neustadt, about thirty miles from Vienna, which contains 400 Students intended for the Infantry and Cavalry; another at Olmutz for the Artillery, containing 200 Students; a third for the Engineers, also containing 200 Students, at Klos-

* The Cavalry School Company has not yet been established, but is provided for in the estimate for the next year.

terbruck near Znaim, in Moravia, 50 miles from Vienna; and a fourth at Trieste for the Marine Service, for 100 Students. The entrance to this last takes place at an age two years earlier than to the others.

The Students who enter the Academies are partly obtained from the Cadet Houses, partly from the Artillery, Engineer, Pioneer, Flotilla, and Marine School Companies, and partly from private instruction; in this last case the Candidates must pass an examination equivalent to that passed by the Students at the end of their fourth year in the Cadet Houses.

United Higher Course for the Artillery and Engineers.

After the Students from the Artillery and Engineer Academies have obtained commissions, and have served two years with their Regiments, such of them as are deserving, and capable of doing so, are then allowed to pass through an United Higher Course of instruction, which is intended to occupy two years, but which, as provisionally arranged, and in operation at the present time at Znaim for the Engineers alone, is now limited to one year.

The Austrian government has commenced the erection of a very extensive establishment at Wiener Neustadt, to serve for the two Academies of the Artillery and Engineers, in lieu of the existing establishments at Olmütz and Znaim, and also for the Officers of those two services who desire to attend the United Higher Course of instruction. The estimated expense of this building, as proposed by an Officer of the Austrian Engineers, the plans of which were shown to us, is stated to be 10,000,000 florins (1,000,000*l.* sterling). A railway of 10 miles in length has already been constructed by the Engineers from its site to that of several marble quarries from which the stone is procured. Machinery has also been erected for cutting the stones, &c., and the foundations of the Academy for the Artillery are already completed.

War or Staff School.

A similar Higher Course, preparatory to entering into the Staff Corps, is provided for the Army in general at Vienna.

Extensive system of Exhibitions given by Provinces and Individuals.

It seems desirable to draw attention to the widely-spread system of exhibitions and free places, common in its main features to France and Prussia, but existing to a greater extent in Austria than in any other country. Thus, in the Cadet Houses and Academies together, there are 900 full and 200 half military or free places, and the remaining students consist of about 230 provincial and private exhibitioners, 300 paying Pupils, and the Pupils (*frequentanten*) from the School Companies.

Proportion of Officers supplied by the Academies and by other means.

Up to the present time, as already stated, only a very small proportion of the Infantry and Cavalry Officers of the Austrian army, not exceeding 1 in 20 or 1 in 30 are obtained from the Military Academies, the majority enter the Army as Cadets, some on the nomination of the Colonels, Proprietors of Regiments, others having claims from the service of their parents on the Regiments, and others recommended from amongst the soldiers in the ranks, after passing a slight examination in Arithmetic and Geography, and proving that they are able to speak and write German (except in Italy, where this requirement is not insisted upon for the Marine), but they are not eligible to be made Officers, even in Italy, unless they know German. They are regularly domiciled with and perform all the duties of the common soldier,* but they *may* be made Officers in the course of a few days, passing however through all the intermediate grades.

Schools visited.

As soon as we had made ourselves acquainted with the general scheme for military education in Austria, we thought it advisable to see the principal Academies at Wiener Neustadt, Olmütz, and Znaim, the Staff School at Vienna, and some of the School Companies and Upper Houses of Education. The Lower Houses of Education being limited to children from seven to eleven years of age, we did not consider that the education given in these would have much reference to the subject on which we were directed to report. We proceed to give an

* The personal pay of the Austrian Soldier is 5 kreutzers per diem (about 2*d.*), in addition to the difference between the ordinary and any extraordinary high price of provisions, and a contribution for meat and vegetables which varies according to the price of provisions in the Provinces, generally amounting to 4 or 5 kreutzers per diem, in addition to a half loaf (3 lbs.) of black bread (*commise brod*). Invalids, who are disabled from wounds, length of service, or old age, are pensioned, and generally lodged. They receive 4 kreutzers, rather more than 1½*d.* per diem, to find themselves, but have a portion of bread, firing, and their clothing given them.

account of the following institutions connected with military education in Austria.—

I. For Officers.
1. The Infantry and Cavalry Academy at Wiener Neustadt.
2. The Artillery Academy at Olmütz.
3. The Engineers Academy at Znaim.
4. The War or Staff School at Vienna.
5. A Cadet House at Hainburg.

II. For Non.-Com. Officers.
6. An Artillery Scientific School Company at Vienna.
7 An Infantry School Company at Klosterneuburg.
8. A Flotilla School Company at the same place.
9. An Upper House of Education at Kuttenberg.
10. The Non-Commissioned Officers' or Teachers' School at Wiener Neustadt.
11. The Bureau of the Geographical Engineers at Vienna.

A very perspicuous account of all the Austrian Institutions for Military Education has been drawn up by the authorities from the full official regulations, of which it is a sort of abridgment. A translation of this is given in pages 199 to 220; and a very useful general view, which forms an Appendix to it, will be found at page 222.

In describing these Schools, we shall adopt the simple division already made into Schools for Officers and Schools for Non-commissioned Officers, the latter of which play so important a part in the Austrian Military System.

The Schools for *Officers* will be arranged under three sections:—

(1.) The Military Academies.
(2.) Schools for the instruction of Officers in special services.
(3.) Junior Schools.

The Schools for non-commissioned Officers will embrace:—

(4.) The School Companies.
(5.) The Houses of Education.
(6.) The Training School for Teachers.

SECTION I.—1. THE WIENER NEUSTADT ACADEMY.

Allusion has already been made in the historical account of the Schools of Prussia to the foundation in 1752, by the Empress Maria Theresa, of a Military Academy at Wiener Neustadt, and some words of Frederick the Great have been quoted in testimony of its early success. It was encouraged and increased by the Emperor Joseph II., whose name appears with his mother's in the inscription under the gateway. Its object was in general to provide the army with scientific Officers, and more particularly to supply the Staff. Its character, however, was quite as much that of a junior school for boys, as of an academy for young men on the point of entering the service; the age for admission was very early, and the direction was, it is stated, left a good deal to the immediate school authorities, no active or continual superintendence being exercised by the Central War Department.

Name and first Origin.

The two other Academies at Olmütz and Znaim for the Artillery and Engineers will, in the course of some few years, be removed and placed, together with the new Senior Department or United Higher Course of Artillery and Engineers, at Wiener Neustadt, where magnificent buildings, as already stated, have been commenced for the purpose. The name, however, of the Wiener Neustadt Academy will be retained by the original military school of the place, the first great military foundation of Austria, the function of which is to supply Officers to the Infantry and Cavalry.

Re-organization in 1853.

Its present form dates, like that of the other places of military education, from the last war, and from the reforms of 1853. The age of entrance to it was fixed at fifteen (or at the utmost sixteen); the Cadet Houses relieved it of its junior classes, and the Fourth Section took it under its energetic control and supervision.

Its situation.

Wiener Neustadt, the intended seat of the three Academies, and the future centre of the military educational system, is a small but ancient and famous town, about thirty miles from Vienna, on the line of railway to Trieste. It is in native Austrian soil; but the Alps of Northern Styria are but three or four miles distant to the west; the Semmering Pass is within sight to the south-west, and eastward the hills of the Hungarian frontier are close at hand. The Academy itself occupies the ancient Château of the Dukes of Austria, standing just outside the town, with a considerable park attached to it. It is entered by a low and massively vaulted gateway, immediately over which rises the chapel. Within is a spacious court with doors leading to the class-rooms.

Points of difference from the other Academies.

The most remarkable point of difference between this and the other two Academies of Olmütz and Znaim is that its pupils come solely from the Cadet Schools, or from places of private education. The system of admission is comparatively exclusive; the annual charge for Paying Pupils is high, and the Foundation Pupils must be very generally the sons of Officers or of noble birth. The question of opening its doors more widely appears to be under consideration, but as yet no *frequentanten* are admitted. Boys of humble parentage, brought up in the Houses of Education, pass in the ordinary course into the School Companies; if admitted to an Artillery, Pioneer, Flotilla, or Marine School Company, they may, if they show great ability, rise from thence to the Academies of Artillery and of Engineers, and enter the path of promotion to the rank of Officer. Soldiers in like manner who show ability in the Regimental Schools of the special arms, proceed in a similar way through the scientific School Companies as *frequentanten* to the Academies at Olmütz and Znaim. It is true that a child at a Lower House of Education, who shows remarkable promise, may be sent to a Cadet House, and thus might obtain entrance at Wiener Neustadt. Cases of the latter kind will, it is to be presumed, ere long occur, but as yet sufficient time has not elapsed since the commencement of the new system to have introduced any such pupils into the Academy; and no admission whatever is granted to pupils from a School Company, or to men who have come from their regiments.

Age of Admission.

Boys for admission must be fifteen years old, or nearly so, and not more than sixteen. Those who do not come from the Cadet Schools have to pass an examination in German Writing, Natural History, French, History and Geography, Geometry, Algebra, and Plane Trigonometry, and in common (free-hand) Drawing. This is equal to the examination passed by the highest class

of the Cadet Institution. It is a high *pass* examination, but we could not ascertain that there was any competition.

Numbers. The whole number is 400, double that of either of the other Academies; there are a hundred for each year, and each hundred is divided into two parallel classes of fifty. Somewhat more than a hundred are, however, admitted every year, as it is always expected that some will, during the four years of the school course, be removed. Those who neglect their duties are sent, if they are foundationers, without hesitation, and if they are paying pupils, with the consent of their friends, to the Non-commissioned Officer Schools (the School Companies), or, if their dismissal take place at the end of the fourth year, they may be allowed to take the military oath, and join a regiment as Cadets.

Subjects of Study. The principal subjects of study are Analytical Geometry and Higher Analysis, carried, it is said, at present, no further than Conic Sections; Mechanics, Spherical Trigonometry, Mathematical Geography and Triangulation, Descriptive Geometry and Surveying; Natural Philosophy, and a little Chemistry; French, Italian, Hungarian and Bohemian; History and Geography, Logic and Psychology (this is said to be very useful as a discipline for correct and intelligible writing and speaking); Military Writing, Military Law and Procedure, some knowledge of the Law of Nations and of the Rights of Austrian Subjects, Fortification, Architecture, Arms and Munitions, knowledge of Ground and Positions, and Military Drawing, accompanied by the usual instruction in Drill, Exercises, and Manœuvres, in Riding, Fencing, &c.

Distribution of Studies. The exact account of the distribution of the studies in each yearly course will be seen by the Table. In general, the rule here and elsewhere in Austria appears to be to complete the theoretical studies, as for example, pure mathematics, as early as possible, to confine these in a great measure to the two first years, and to leave the student's attention free during his two last years for the strictly professional and more practical matters.

Table of Studies.

Subjects of Study.	Number of Hours given Weekly in each Yearly Course.			
	Year I.	II.	III.	IV.
Religious Instruction	1	1	1	1
French	3	3	3	3
Philosophy (Logic and Psychology)	2	—	—	—
Italian	..	..	3	3
Bohemian	1½	1½	1½	1½
Hungarian	..	..	3	3
Algebra and Analytical Geometry and Mensuration	7½	—	—	—
Mechanics, Spherical Trigonometry, Mathematical Geography	..	7½	—	—
Descriptive Geometry	3	3	—	—
Natural Philosophy and Chemistry	..	..	4½	4
Military Writing and Administration	3	3	3	3
Geography	3	3	—	—
History	3	3	—	—
Building	..	..	3	—
Arms and Munitions, and Artillery	..	..	3	—
Pioneering	..	..	..	3
Fortification	..	..	..	3
Tactics of the Three Arms	..	..	..	6
Rules of Infantry Drill, Exercise, and Manœuvring	1½	1½	1½	1½
Cavalry ditto	..	..	1½	1½
Military Penal Law and Procedure	..	..	..	2½
Military Drawing, Surveying	6	6	4	4
Riding	..	..	4	6
Fencing	2	2	4	4
Gymnastics	2	2	2	2
Dancing	2	2	2	2
Rules and Regulations	1½	1½	1½	3
	42	40	45½	53

Mode of study and daily routine. The class-rooms here, as in the other Austrian schools, serve at once as lecture or lesson rooms, and as halls of study. There are only these and the sleeping-rooms. There are no chambers (*Wohnzimmer*) for living in, as in Prussia. When the pupils are not actually at their lessons with the teacher, they prepare for them, and write out notes upon them in the same room. Some change of place is

supplied by the drawing-rooms, of which there are two, one for military, and the other for ordinary drawing, both spacious rooms, and well supplied, the former with raised models with contour lines, the latter with busts, &c.; as also by the lecture-rooms for Natural Philosophy and Chemistry; by the gymnastic and the riding schools; and, above all, by the playground, which is superior to anything else of the kind which we saw on the Continent. The old park of the Château furnishes abundant room for games and exercises of all kinds. We found the pupils amusing themselves when we went into it at prisoner's base, with walking on stilts, &c. &c. There are numerous walks among the trees, and the whole is overlooked by the Alps of Styria on the west, and the hills of Hungary eastward, both which are resorted to on Sundays and holidays in long walking excursions. The students are usually allowed for recreation in the park about two hours at different times in the day. The general distribution of time was said to be as follows:—They rise at 5 or 6 A.M., according to the season, dine at 12, sup at 8 P.M., and go to bed at 9. The rest of the day, deducting the two hours of recreation, and some occasional time for gymnastics, fencing, and riding, is spent at work in the class-rooms. During the hours of private study (the *Arbeitstunde*), they are overlooked by an Officer, but except (to a certain extent) in mathematics, they receive no help from the teachers. Distribution of Time.

At the actual lessons the system is the usual German one; there are parallel desks on the same level, and a black-board at the end of the room. The usual number was 50, for which the desks supplied very sufficient accommodation. The pupils of the first year were, when we were admitted to see them, engaged in a lesson of Plane Trigonometry. The Professor was questioning a boy who worked out a problem at his side on the black-board. In a second room, 50 of the second year students were attending a lecture on History; two were called up, and related in a creditable manner the principal events of the first years of the French Revolution; this part of history being treated as an introduction to the great wars between Austria and France. The young men of the third year were engaged in a lecture on Natural Philosophy; and those of the fourth in one on Permanent Fortification.

The Director of the School is a General or Colonel. Three Field Officers and thirty-four Captains and Subalterns assist in the studies and in maintaining order and discipline; there is a very numerous staff of attendants.* The Staff.

The general arrangements in the building are all equally commendable. The dormitories are lofty and well ventilated, each containing fifty beds; the dining halls good, the kitchen clean, and the food excellent. For the riding school, sixty-two horses are kept at present, and a greater number are to be procured. The library, superintended by an ecclesiastic, contains a considerable collection of books. The chapel, in keeping with the ancient château, is of historic interest, as containing the tomb of the Emperor Maximilian. The students attend the church service at an early hour on Sunday, are employed for some- General Arrangements.

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* As the number of attendants, &c., appears to be excessively large, we give a complete list of all persons belonging to the Wiener Neustadt Academy.

1	Director.
1	Subaltern Officer as his Adjutant.
3	Field Officers.
4	Captains, Commanders of Companies.
26	Captains and Subaltern Officers, the Captains not less than 8 in number.
1	Military Judge (*Auditor*) as Professor.
4	Ecclesiastics.
23	Sergeants for inspection.
1	Captain as Riding Master.
1	Subaltern Officer as second ditto.
45	Non-commissioned Officers and Soldiers in attendance on the Riding School.
2	Army Surgeons.
1	Surgeon's Assistant.
5	Attendants on the Hospital.
3	Orderlies (*Führer.*)
5	Accountants.
4	Civilians employed in the garden, &c.
55	Servants.
40	Officers' servants.
3	Non-commissioned Officers } for the Drill, Exercises, &c.
60	Private Soldiers }
308	
64	Horses for the use of the Students.

time during the morning in writing and drawing, and then go out under the superintendence of one of the Officers for excursions of some length in the neighbourhood. The ecclesiastical festivals are observed as whole holidays, but since the time of Joseph II., these have been limited to the number of twelve.

State apartments, adorned with the portraits of the Emperors, are reserved for the occasional visits of the Sovereign. The quarters of the Director are similarly ornamented with the portraits of his predecessors in office from the first foundation of the school; and the examination room with those of distinguished Generals, the majority of them former pupils of the Academy.

Promotion.

There are yearly examinations conducted on the same general plan described in the account of the Academy at Znaim; after the last, the list is drawn up, and the young men pass, as far as possible by choice, offered in order of merit, into the various regiments of Infantry and Cavalry. Their seniority is fixed by the list of classification. They enter as Second Lieutenants of the second class. Their outfit is paid for by the State, except in the case of those who enter cavalry regiments; commissions in these appear to be reserved for the sons of wealthier families, and no one can enter whose friends do not pay down a certain sum for his immediate equipment, and guarantee him a certain monthly allowance over and above his pay.

SECTION I.—2. THE ARTILLERY ACADEMY AT OLMÜTZ.

Present provisional form.

This Academy is at present in a provisional form, different from that it will receive when transferred to Wiener Neustadt. The young men attending it should, according to the new organization, be 200 in number; 40 taken from the School Companies, and 160 from the Cadet Schools, and from places of private education. But up to April 1856, no pupils from the Cadet Schools had been received; the school had not as yet passed into the new order of things; the classes were filled with paying pupils and attendant pupils (*frequentanten*), the former coming from places of private education, the latter the superior pupils of the School Companies. The earliest admission of boys from the Cadet Schools would not take place before the month of October 1856. In several respects the process of change from the older system appears to have been slower here than elsewhere.

System up to the year 1848.

Formerly, the Officers of the corps of Artillery were taken largely from the ranks. Young men in the Regimental Schools, who showed promise, were sent to a special institution, often spoken of amongst the Artillery Officers of the present time, the Bombardier School. Here they remained for five years, studied hard at mathematics, which they carried to a considerable height; but in such points as French they are said not to have been so proficient. After these five years they returned to the service, and in the course of time received the rank of Lieutenant.* Intermixed with these attendants on the Bombardier School, were a certain number of Imperial Cadets, admitted at an earlier age, and allowed considerable privileges in the way of promotion. The Officers whom we found in charge of the school at Olmütz were, with one exception, old Bombardier scholars.

Changes of 1851 and 1853.

This system continued in operation down to the late wars. In 1851, Olmütz, a fortified town, which had always been the station of an Artillery regiment, was chosen as the seat of a Special Artillery School, to take the place of the Bombardier School; and in 1853, this was adopted into the new organization as the Artillery Academy.

Building.

The building which it occupies is a part of an immense establishment formerly erected by the Jesuits; but a considerable space is used for barracks; and the portion assigned to the Academy is scarcely sufficient for the purpose. The Director and a large number of the Officers lodge in the town. Two are always on duty in the school; but the remainder, when not employed in giving instruction, are absent.

Staff.

The Staff consists of a Director (a Colonel of Artillery), with a Subaltern Officer as his Adjutant, two Field Officers, two Captains in command of the two Companies, twenty Captains and Subaltern Officers, one Military Judge (*Auditor*) as Professor of Law, two Ecclesiastics, a Captain of Cavalry as Riding Master. Twelve Sergeants for inspection, who sleep in the dormitories and attend in the class-rooms, and a body of eighty servants and forty soldiers on duty, raise the whole establishment to the number of 192, in addition to the pupils.

Studies.

The course of study, as in all the Academies, is of four years' duration; the students are divided accordingly into four classes, each containing about fifty; the two first years form one company, the two last years a second.

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* The whole preparatory course appears to have amounted to something like sixteen years; one year's service after enlistment, two years in the Regimental School, five in the Bombardier School, and eight of service as Sergeants after leaving the School. The Imperial Cadets, generally the sons of Officers, got their promotion soon after leaving the School. It is at the present time not unusual for Officers to send their sons, with a view to their obtaining commissions, to the Artillery School Companies.

The nature of the studies will be best seen from the following Table:—

TABLE OF STUDIES.

Subjects of Study.	Number of Hours given to them Weekly in each Yearly Course.			
	Year 1.	Year 2.	Year 3.	Year 4.
Religious Instruction	1	1	1	1
Philosophy	2	–	–	–
French	3	3	3	3
Bohemian	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
Algebra, Analytical Geometry, and Mensuration	10	$7\frac{1}{2}$	–	–
Mechanics	–	9	$7\frac{1}{2}$	–
Descriptive Geometry	$4\frac{1}{2}$	8	3	–
Mathematical Geography	–	–	$1\frac{1}{2}$	–
Physics and Chemistry	–	$4\frac{1}{2}$	$4\frac{1}{2}$	–
Military Correspondence and Administration	3	3	3	3
Geography	3	3	–	–
History	3	3	–	–
Arms and Munitions, and Artillery	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	3
Field Fortification	–	–	3	–
Permanent Fortification	–	–	–	$3\frac{1}{2}$
Tactics of the Three Arms	–	–	–	3
Rules of Artillery Drill, Exercise, and Manœuvres	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
Military Penal Law and Procedure	–	–	–	$2\frac{1}{2}$
Military Drawing and Surveying	4	4	2	2
Riding	–	–	$10\frac{1}{2}$	$10\frac{1}{2}$
Fencing	2	2	2	2
Gymnastics	2	2	2	2
Dancing	2	2	2	2
Rules and Regulations	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	3
Total	$45\frac{1}{2}$	61	54	$44\frac{1}{2}$

The program actually carried out at present differs in some particulars from this, which is that of the new system, not as yet completely brought into practice.* The mathematical instruction, for example, consists at present of ten hours of Algebra and Analytical Geometry, in the first year; three hours of Differential and Integral Calculus, in the second; and six hours of Mechanics in the third. Descriptive Geometry is continued throughout the whole four years. It would seem that the pupils at their first entrance are not as thoroughly grounded, or as far advanced in these subjects as it is intended in the course of time to require them to be.

Daily routine.

The daily routine varies with the courses and the classes; but the following account will give a general notion:—

5 to 6 A.M. Allowed for rising, dressing, and breakfast.
6 to 9 „ Studies.
9 to $10\frac{1}{2}$ „ Half an hour's recreation, and one hour's repetition.
$10\frac{1}{2}$ to 12 „ Exercises or drawing.
12 to 1 P.M. Dinner.
1 to $1\frac{1}{2}$ „ Recreation.
$1\frac{1}{2}$ to 3 „ Studies.
3 to 5 „ Gymnastics, riding, and fencing
5 to 7 „ Studies (*e.g.* French), and half an hour's recreation.
7 to $8\frac{1}{2}$ „ Recreation and supper.
$8\frac{1}{2}$ to $9\frac{1}{2}$ „ Repetition or studies in the class-rooms.

Examinations.

The examinations are oral, and they are solely conducted by the Professors. A classification in order of merit is formed at the close of each year; those at the close of the last year, which in combination with the results obtained on previous occasions, determine the order of seniority in the appointments, are held in the presence of the Director, the whole number of Field Officers, and the Officer in command of the company. They appear in every point to resemble those of the Engineers Academy at Znaim, in the account of which further particulars are given.

* In the more detailed account mention is also made of attendance at the *Laboratorium*, and of lessons on the construction of batteries, and in rockets; as also of instruction in various matters relating to horses, both theoretical and practical.

Class-rooms.

The class-rooms, serving also as studying rooms, are four in number, one for each of the classes, and answering to the four years of study. The desks are arranged in parallel rows, facing the Professor. At the time of our visit the young men were engaged preparing their lessons. There is always a Staff-Sergeant present in each room during the hours of study. One large drawing room serves for the four classes, who draw in turn.

There is also a very excellent lecture-room, communicating on one side with the chemical laboratory, on the other with the physical cabinet. The collection in the latter is good and extensive.

Dormitories

The sleeping accommodation of each class consists of two rooms, a larger and a smaller. In the latter the *frequentanten*, to the number of about ten to each class, are to sleep. As no Cadets have yet arrived, this separation has not yet taken place.

Refectory, &c.

The young men dine all together. The tables were arranged, at our visit, for dinner; we saw it nearly prepared afterwards in the kitchen; it was excellent and abundant.

The boots and clothing of the pupils are all made and repaired in the building by workmen detached from their regiments for the purpose. In one room were the tailors, in another the shoemakers.

The building is close to the ramparts. In the works adjoining, a space has been set apart for a gymnastic ground, and a portion of a ditch is to be used for the swimming school.

There is also a riding school.

Generally speaking the institution bears more obviously the marks of its being in temporary and provisional quarters than is the case with the corresponding Academy at Znaim. If we are rightly informed, the portion of buildings at Wiener Neustadt to be most quickly completed will be that intended for the Artillery.

Promotion.

On the satisfactory completion of the four years' course, the young men receive their commissions as Second Lieutenants in the Artillery.

SECTION I.—3. ENGINEER ACADEMY AT ZNAIM.

Visit.

On the 12th April we were informed by Lieutenant-General Gorizutti, the chief of the Fourth Section for Military Schools of the Supreme War Department, that he proposed leaving Vienna for Znaim to make his inspection of the Engineer Academy, on Monday evening the 14th instant, and he was good enough to ask us to accompany him. This we accordingly did, and thus had the benefit of going over the establishment with him, and of hearing his views on the subject of Military education in Austria.

The Engineer Academy was first established by M. Griener (a civilian) in 1736 or 1742, at Vienna, but was removed to Klosterbruck, near Znaim, in Moravia, in October 1851.

Origin and situation of the Academy.

The Academy is established in an old convent, which formerly belonged either to the Jesuits or Benedictines, immediately above the river Thaya; it is about three quarters of a mile from and is directly under Znaim, which stands on high ground overlooking a considerable extent of country. This building was purchased by the Government not very long since, and its cost, together with the various reparations, alterations, and additions requisite for so large an establishment, is said to have amounted to about 1,000,000 florins.

Staff.

The Military Staff of the Academy consists of—

1 Director, who is usually a General or Colonel belonging to the Engineers.
1 Adjutant.
2 Majors belonging to the Staff of the Engineers.
9 Captains.

The Professors, twenty-six in number, are, with two exceptions (drawing and dancing), all military men, and they are located in a separate building called the Pavilion, immediately contiguous to the Academy. Lieutenant-General Gorizutti informed us that the substitution of military for civilian Professors had been attended with good results in the conduct and exertions of the students.

Number and different classes of Pupils.

The students at the Academy are received from the Cadet Houses, from private instruction, and in a variable proportion of from two to ten per company yearly, from the superior pupils belonging to the School Companies, for the Engineer and Pioneer services. These last students are the *frequentanten*, or attending scholars, and during their residence at Klosterbruck, as at Olmütz, they are kept quite distinct from the others as regards their living, sleeping, studies, and examinations. The final examination at the end of the fourth year is, however, made in common, when all are arranged in a single list in order of merit.

The Academy is intended to contain 200 students, of whom 160 enter from the Cadet Houses and from private instruction at the age of fifteen,* and remain for four years, and 40 are *frequentanten* from the School Companies; but at the time of our visit the actual number present only amounted to 178, made up in the following manner:—

	Students.	Frequentanten.	Total.
Of the first year's residence there were present	41	10	51
„ second „ „ „	30	10	40
„ third „ „ „	32	0	42
„ fourth „ „ „	38	7	45
Total present - -	141	37	178

The first and second years' students form one company, and the third and fourth years' students make a second company, and it will be seen from the above statement that the first is the only year which contains the full complement (fifty) of students, owing to casualties and the removal of incapable or undesirable students. We were told that this was the case generally at the

* The paying pupils contribute 60*l.* (600 florins) per annum for the first three years, and 80*l.* (800 florins) for the last year.

present time throughout all the Academies and other institutions for military education in Austria.*

The instruction is communicated to the students by classes of about fifty each, the number entering each year forming a class. The class rooms, or halls of study (they serve for both purposes), are sufficiently large to hold this number, and the students are mostly arranged at parallel desks placed across the halls, with a passage down the centre, three being usually placed at each desk, but it appeared to us that they had somewhat too little space for effective work. Studies.

The Authorities are now engaged in preparing text books for the use of all their Military Schools and Academies, the greater portion of the books in use being merely provisional. The Professors lecture and the students take notes, which they subsequently perfect, and in doing so, they are in the practice of applying for assistance to the students at the head of their class, as well as of referring to their text books.†

The following Table gives a view of the usual routine of the student's life at the Academy:— Daily routine.

During the Summer Months.	Occupation.	During the Winter Months.
h m h m		h m h m
5 0 A.M. to 5 30 A.M.	Rise, Dress, Inspection and Prayer.	6 0 A.M. to 6 30 A.M
5 30 „ 6 30 „	Breakfast, &c.	6 30 „ 7 0 „
6 30 „ 7 0 „	Preparation	7 0 „ 7 30 „
7 0 „ 8 30 „	Studies	7 30 „ 9 0 „
8 30 „ 9 30 „	Report and Walking, Fencing	9 0 „ 9 30 „
9 30 „ 12 0 „	Studies of two descriptions	9 30 „ 12 0 „
12 0 „ 1 0 P.M.	Dinner	12 0 „ 1 0 P.M.
1 0 P.M. 2 0 „	Walking and Recreation	1 0 P.M. 2 0 „
2 0 „ 8 0 „	Studies and Repetition, broken at intervals by Riding, Dancing, Fencing, Gymnastics.	2 0 „ 8 0 „
8 0 „ 8 30 „	Supper	8 0 „ 8 30 „
8 30 „ 9 0 „	Recreation	8 30 „ 9 0 „
9 0	Bed	9 0

So that the studies with the Exercises, Drill, Riding, Fencing, Swimming and Gymnastics, altogether occupy about ten hours daily.

The principal subjects of study during the first year are Algebra, Analytical Geometry, and Mensuration, which together occupy about one-third of the student's time. German, French, and Military Drawing, on an equality, come next; then follow History, Geography, and Gymnastics; Fencing and Dancing succeed, and the Rules of Drill and Exercises, the Rules and Regulations of the Service, Calligraphy, and Religion, are allowed about the same amount of time. Swimming is regularly practised during the summer months. Subjects of Study during the first year.

* Formerly the Director had the power of admitting any students he thought proper after they had undergone a very slight examination; the payments by the parents only amounted to 15 florins yearly; but this system was entirely done away with when the new system of Military education, which we have already described, was introduced in 1853.

† We were conducted with General Gorizutti through the various class-rooms, and allowed to hear two or three pupils in each who were called up by the Professor, questioned, and examined.

In the first, fifty-one pupils, including ten *frequentanten*, of the first year, were at work on Spherical Trigonometry. In another, forty pupils of the second year were engaged on the Differential and Integral Calculus. In the next, forty-one were just finishing their lesson in Mechanics, and before we left, commenced their ensuing lesson in French. The forty-five pupils of the fourth year were studying Military Law and Procedure under a Military Law Officer or *Auditor*.

In all these classes the methods were those usual in England and Germany; it was in all cases much more a lesson than a lecture. The pupil was called up before the teacher to the black board, was asked questions, was set to work problems on the board, explaining each step as he put it down. The latter task was done remarkably well by a pupil in Mechanics. A young man of Polish birth was requested (on this particular occasion) to work his problem, giving the explanation in French, which he did with considerable facility. In the actual French lesson, two pupils were called up in succession, one of whom wrote on the board a French sentence from dictation, which he afterwards read, translated, and parsed; the second translated a German sentence into French. The pupils then read in succession from their seats about half a page of French. The instruction appeared to be well given and well received.

System not unlike that followed in the French Schools.

In the provisional course of instruction now in force at Znaim there is some slight resemblance to the French system. The difficult lesson of the day is given in the morning; it never exceeds one and a half hour in length, and during the two first years is invariably followed in the afternoon by a repetition of the same subject. Independent of the direct repetition of this, the most difficult lesson of the day, there is a good deal of time devoted weekly to the repetition of some of the other studies.

Studies during second year,

In the second year the change in the studies consists in the Higher Analysis, including the Differential and Integral Calculus, taking the place of Algebra, Analytical Geometry, and Mensuration, and Descriptive Geometry is introduced.

third year,

In the third year, the Higher Analysis gives place to Mechanics; Mathematical Geography almost entirely supersedes ordinary Geography; History is changed to Military History, and Natural Philosophy, Chemistry, and Military Composition are introduced. The students of this year commence Riding.

fourth year.

In the fourth year, Mechanics, Mathematical Geography, Natural Philosophy, Descriptive Geometry are discontinued, and Fortification, Civil and Military Architecture, Arms, Munitions, and Artillery, Tactics of the three Arms, Military Law, and the Pioneering Service are introduced. There is also a short course of instruction in Sapping, Mining, and Practical Exercises, one month being allowed for each. The students cut the first sods and commence the work, and the Engineer soldiers attached to the Academy complete it.

The instruction in Fortification appears to be of a higher order than is usual in Military Academies, inasmuch as the students are called upon to draw up projects of different kinds. The Architectural course includes instruction not only in mere building, but in Civil Architecture, and the preparing projects and designs, with corresponding estimates, for new works.

Weight allowed to the various subjects.

The *importance* or *weight* allowed to the various branches of study is as follows:—Arithmetic, Algebra, Geometry and Plane and Spherical Trigonometry and Practical Mensuration, Analytical Geometry and the Higher Analysis, Mechanics, Natural Philosophy and Chemistry, Military Composition, Fortification, Building, Descriptive Geometry, are each reckoned as two; whilst French, German, History, Geography, Mathematical Geography, Military Law and Procedure, Pioneering Service, Arms Munitions and Artillery, Architecture, Military Drawing, Calligraphy, Rules of Drill and Exercises, and the Rules and Regulations of the Service are only valued at one.

Internal Arrangements.

There is a very good Library belonging to the Academy; and situated on the same floor with it, there is a model room, provided with a large number of very good models necessary for the instruction in Fortification, in the attack and defence of fortified places, in constructions of various kinds, and in Architecture, together with large models of ground for the efficient teaching of Tactics.

There is also a good Lecture-room, with an Amphitheatre, and a small Laboratory in connexion with it.

We found the State room, adjoining to the room in which the examinations are held, filled with portraits of celebrated and distinguished Generals and other Officers, who had mostly been educated at the Engineer Academy. Both here and elsewhere we could not avoid observing that every means of this kind calculated to cultivate the martial spirit of the Austrian youth is provided at most of their Educational Establishments.

We may also remark that the principle acted on of sending the youth of the Southern Provinces to the Northern Educational Establishments, and *vice versâ*, together with the restriction that none can be promoted to the rank of Officers who do not know the German language, is evidently the result of a well considered policy.

The following Table exhibits the number of hours devoted every week to each subject, as well as its weight or importance given in the first column :—

Tabular View of the Subjects of Study, their relative Influence, and the Number of Hours devoted to them Weekly.

Engineer Academy.

Influence.	Subjects of Study.	Number of Hours given Weekly in each Yearly Course.			
		1st.	2nd.	3rd.	4th.
–	Religious Instruction	1	1	1	1
–	Philosophy	2	–	–	–
1	French Language	3	3	3	3
2	Algebraic and Analytical Geometry and Mensuration	10	–	–	–
2	Mechanics, and the Elements of Machinery	–	9	–	–
2	Descriptive Geometry	3	3	–	–
1	Mathematical Geography	–	–	$1\frac{1}{2}$	–
2	Physics and Chemistry	–	$4\frac{1}{2}$	$4\frac{1}{2}$	–
2	Military Correspondence and Administration	3	3	3	3
1	Geography	3	3	–	–
1	History	3	3	–	–
2	Building	–	–	$4\frac{1}{2}$	6
1	Architecture, Plain and Ornamental	–	–	–	$7\frac{1}{2}$
1	Arms, Munitions, and Artillery	–	2	2	2
1	Pioneering	–	–	–	$1\frac{1}{2}$
2	Field Fortification	–	–	$4\frac{1}{2}$	–
2	Permanent Fortification	–	–	–	$4\frac{1}{2}$
	Tactics of the Three Arms	–	–	–	$1\frac{1}{2}$
1	Drill Exercises. Rules for the Engineers ; Infantry Manœuvres, Drill	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
1	Military Penal Law and Procedure	–	–	–	$2\frac{1}{2}$
1	Military Drawing and Surveying	4	4	2	2
–	Riding	–	–	6	3
–	Fencing	2	2	2	2
–	Gymnastics	2	2	2	2
–	Dancing	2	2	2	2
–	Rules and Regulations	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
	Total	41	$44\frac{1}{2}$	41	$43\frac{1}{2}$

Examinations entirely oral, and solely conducted by the Professors, take place at the end of each month, and a class list is arranged in the order of merit at the end of the half-year. This is done with more formality at the end of the year. The final examinations at the end of the fourth year are held before the Director of the Academy and one or more of the Staff Officers belonging to the establishment. Occasionally a General Officer is sent specially to the Academy to preside at the examination at the end of the year. Examinations.

The monthly examinations are perfectly independent of each other, and of any preceding examination, and the result at the end of the half-year is obtained by taking the mean of the results of the several months.

The credits or marks awarded to each student for the manner in which he has passed his examination in every branch of study, are as follows :—E. e. 1. 2. 3. System of marks or credits.

E. Signifies exemplary progress, a quick and correct apprehension of the subjects treated of, and the power of going through them immediately afterwards with the assistance of the Professor ; general and thoroughly grounded knowledge of what has been taught, and a good manner of expression.

e. Good progress ; quickness of apprehension, but in a less degree ; general and well grounded knowledge, and a good manner of expression.

1. Pretty good progress ; sufficient knowledge of principles to be enabled to comprehend the ensuing subjects, and to make satisfactory progress.

2. Moderate progress ; incomplete knowledge of the subjects, and want of the knowledge required for further progress, without, however, incapacity for acquiring it by further study or greater diligence.

3. Little or no progress ; ignorance of things, and an incapacity for comprehending the further subjects of instruction, or of making satisfactory progress.

There are thus three marks for satisfactory progress, and two for unsatisfactory, and they have the following numerical values attached to them :—

E = 4 ; e = 3 ; 1 = 2 ; 2 = 1 ; 3 = 0.

For the half-yearly and yearly examinations, the total credit for each student is found by adding into one sum the numerical values of the several marks awarded, and in the event of certain studies having been finally completed in a

preceding half-year, their numerical values are brought forward and included in the general total.

Classified list of merit.

The classified list is made out by arranging the students in the order indicated by the totals they have severally obtained; the student who has the greatest numerical result being placed first on the list, and in the event of equality of numbers, the precedence is given to the student with the highest mark in bodily exercises, to which otherwise no influence is allowed, and if this test be insufficient to establish the precedence, it is then determined according to their order of merit in the previous year, and during the first year by the decision of the Director.

In bringing forward the result obtained by a student in any branch of study, at the conclusion of a half-yearly or yearly examination, so that it may be taken into account with the marks awarded during the several preceding months, the half-yearly or yearly mark, as the case might be, is only placed on an equality with the result furnished by a single month.

Results of the half-yearly examination of the fourth year's class.

We were favoured with an abstract of the numerical totals obtained by each of the students belonging to the fourth class, corresponding with the fourth year of residence, at their last half-yearly examination, and as it is of course the best practical proof we could procure, shewing to what an extent the students had fulfilled the expectations of the Professors, we herewith append it. The maximum numerical credit that could have been obtained was 120.

Ordinary Students.						Frequentanten.	
Order in the Class List.	No. of Credits.	Order in the Class List.	No. of Credits.	Order in the Class List.	No. of Credits.	Order in the Class List.	No. of Credits.
1	116	14	99	27	77	1	114
2	116	15	96	28	72	2	111
3	115	16	91	29	72	3	107
4	114	17	89	30	71	4	99
5	112	18	88	31	71	5	98
6	112	19	88	32	66	6	96
7	109	20	86	33	65	7	80
8	109	21	83	34	65		
9	103	22	83	35	64		
10	103	23	83	36	63		
11	103	24	79	37	60		
12	100	25	78	38	49		
13	100	26	78				

It was mentioned that the first in the order of merit was not the best mathematician, and that the latter, who was stated to possess superior mathematical attainments, was kept back solely by an incapacity for drawing.

It will also be noticed that only in one instance does the numerical result fall below the half of the maximum credit which could have been obtained.

Removal and Promotion.

The *frequentanten*, who are supplied from, and previously pass two years in, the Engineer and Pioneer School Companies, are usually of the age of seventeen when they enter the Academy, or about two years older than the Students entering from the Cadet Houses or from private instruction, so that the preceding return of the credits actually obtained, speaks very favourably for the qualifications of the ordinary students when compared with those of the *frequentanten*. Prior to entering into the Academies, the *frequentanten* are obliged to take the military oath, and receive the rank of Lance Corporal.

Transfer to Infantry and Cavalry Academy for insufficient qualifications.

In the event of any of the students being found insufficiently qualified in mathematical knowledge, but possessed of good conduct and of sufficient ability in other respects to make good Officers, they are transferred to the Infantry and Cavalry Academy at Wiener Neustadt, and we were told that this had frequently happened.

Since the introduction of the new system, we were informed that about 100 students had been removed from this Academy in the course of three years as not likely to pass through the course of instruction in a satisfactory manner; but that the removals during the last three months had not exceeded two or three; and among the 100 removed were a considerable number of the sons of the Nobility.

On the satisfactory completion of the fourth year's course the students enter the Engineer or Pioneer Service, with the rank of Second Lieutenants of the

Second Class, if there are vacancies for them. If there are not a sufficient number of vacancies to admit all, the remainder go into the Infantry.

Riding School. Swimming School.

There is a riding house belonging to the Establishment, and thirty-six horses are kept for the exclusive use of the students. There is also a covered swimming school at the side of the River Thaya, and two very complete sets of gymnastic apparatus, one under cover, and the other in the open air for summer exercises.

Very great attention is paid to riding, gymnastic exercises, skating and swimming in Austria; and boys who have joined the establishment weak and inactive are said, in a very short space of time, to have had their health improved, and to have become expert and active by the nature of the training they undergo.

The Gymnastic Masters are obtained from the Teachers' School at Wiener Neustadt, so that one uniform system is adopted throughout the Empire; and it was stated to be the intention of the Government to cause the whole army to be trained to these exercises.

Dormitories.

The students sleep in dormitories sufficiently large to contain the beds for the whole of a class. Each student is supplied with a small chest of drawers. The sleeping-rooms were mostly on the first and second floors, the rooms being lofty and very airy. Their ablutions are performed in the same rooms. Two Staff Sergeants sleep in each room, their beds being screened off from the others in opposite corners of the room.

Hospital.

The hospital in the upper story contained, at the time of our visit, eight patients, but it was said that the usual number of sick was not nearly so many.

Refectories

Adjoining to the hospital was a small kitchen, used for the purpose of preparing small comforts for the sick. The students dined in two large refectories on the basement story, having a communication between them. The Officers on duty and Staff Sergeants dined with them. Fourteen sat at each table, and one of the Officers on duty or a Staff Sergeant sat at one end of each table, and the senior student at the other end.

Vacation.

The students have a yearly vacation of six weeks, commencing on the 15th of August.

Discipline.

The discipline is maintained and supported by means of the Staff Sergeants, who are instructed to *report* any irregularities or impropriety of conduct that they may notice, but they do not possess any power actually to stop it whilst it is going on. About thirteen Sergeants, having more than four years' service, are employed on this duty and in carrying on the instruction in drill, gymnastic exercises, and swimming in this Academy; and such of them as may be qualified are employed as *répétiteurs* in the class-rooms to give assistance in the mathematical studies.

When they have completed six years of good service and good conduct in this Academy they are promoted to Lieutenants of the second class, and such of them as are distinguished by their zeal or ability as *répétiteurs* may hope to be promoted prior to the expiration of the six years.

One Sergeant, two Corporals, and 40 Men of the Engineers belong to the Academy, for the purpose of taking part in the practical exercises, mounting guard in the building, cleaning the arms, making and repairing the clothing, &c.

Promotion in the Corps of Engineers.

Prior to the Hungarian war the Engineers and Sappers and Miners formed distinct corps. There were at that time fifteen companies of Sappers and Miners, seven of Sappers to eight of Miners; but in 1850 the Engineers, Sappers and Miners were united; and the combined corps of Engineers now consists of twelve battalions of Engineers, each battalion containing four companies, and each company divided into four sections,—one of Miners to three of Sappers; but the whole are trained to the duties required from the Sapper.

Each company has four Officers; and since the amalgamation took place, a portion of the Officers have been promoted from among the Non-commissioned Officers, and the remainder have been obtained from the ordinary students at the Academies, in the proportion of one from the Non-commissioned Officers to three from the Academies. The subsequent promotion is entirely by seniority. A considerable portion of the Officers of the corps of Engineers are now attached to companies of Engineers, to do regimental and military field duty with them; and the remainder do duty in the fortified towns and places, and are placed on what is termed the Staff of the Engineers.

The pontooning forms a portion of the duty of a distinct corps of Pioneers, supplied with Officers who are educated at the Engineer Academy at Znaim

SECTION II.—1. UNITED HIGHER COURSE FOR THE ARTILLERY AND ENGINEERS.

Intended Higher Course for Twenty Officers of each Corps, admitted by an Examination.

A species of Senior Department or Higher Course of Instruction for unmarried Officers of the Artillery and Engineers has been determined upon, and is already provisionally in operation as regards the Engineers at Znaim; such a course for the Engineers having existed prior to the Hungarian war.

Twenty Officers from each corps, of more than usual attainments, between twenty-one and twenty-six years of age, and two years of actual service with their regiments, are to be admitted annually to go through the Higher Course of Instruction, if they are the successful candidates in a preliminary examination; the subjects of examination being Analytical Geometry and the Higher Analytical Mathematics, Mechanics and the Elements of the Theory of Machines, Natural Philosophy and Chemistry, Military Composition, French, and Military Drawing. The Artillery candidates will be also examined in the Tactics of the three Arms, and in Artillery; whilst the Engineer candidates will be examined in Fortification and Architecture, plain and ornamental.

We were informed by an Officer of the Austrian Engineers that it was probable that not more than one in four would be found qualified to pass the preliminary examination, and he appeared to entertain considerable doubts of the propriety of insisting on the two years' service, as he thought many would be likely in the interval, to forget the knowledge they had acquired prior to obtaining their Commissions.

Duration of course.

The examinations are to be made by the Professors belonging to the Artillery and Engineer Academies.

Subjects of instruction in common.

The course of study is intended to last two years; that already provisionally in operation at Znaim is only for one year.

The instruction to the two arms is to be part common and part separate. Common as regards the following subjects, viz.,—

Mechanics as applied to Machines, combined with Machine Drawing, and instruction in subjects relating to Railways; Natural Philosophy and Chemistry, combined with practice in manipulating and in making experiments and analysing; the Theory of Artillery, in reference to the constructions that occur in Artillery; Higher Tactics; the Principles of Strategy, illustrated by campaigns, with special attention to the use of Artillery in the Field and in the Attack and Defence of fortified places. Also practical guidance and supervision in all subjects of a scientific nature connected with the Art of War.

Subjects of separate instruction.

Separate as regards the following subjects:—

FOR THE ARTILLERY.

1. Service in Workshops, Depôts, and Arsenals. 2. Knowledge of Foreign Artillery, of the requisites for Field Service and Sieges, and for furnishing Fortified Places.

FOR THE ENGINEERS.

1. Ornamental Architecture, combined with Architectural Drawing and Projects and Designs for Works. 2. The Art of Fortification, special attention being given to working out Projects for Fortified Places, and Systems of Attack and Defence. A Course of Mines and Countermines, with Projects for the same; also for Hydraulic Constructions and Bridges.

Distribution of Time in the provisional Higher Class of Engineers at Znaim.

The distribution of time devoted weekly to the several studies in this provisionally arranged Higher Class of Instruction for Officers of Engineers is as follows:—

Artillery	2 hours.
Arms and Munitions	1 ,,
Architecture	6 ,,
Building	3 ,,
Chemistry	1½ ,,
Fortification	4½ ,,
French	3 ,,
Natural Philosophy	3 ,,
Problems in Fortification and Architecture	36 ,,
Total weekly	60

The mornings are given up to the lessons in the several subjects, and the afternoons, from 2 o'clock till 8, to the working out of problems in Fortification and Architecture. Present arrangements.

In passing through the Academy at Znaim we saw a Class of Fifteen Officers of Engineers, who constitute this provisional class, engaged on a Lecture in Fortification. These Officers do not reside in the Academy.

At the conclusion of their Course of Study they are to undergo an examination, and their promotion from the rank of Second to that of First Lieutenant is made to depend on the results of that examination.

When promoted they are placed on the Staff of the Engineers and stationed in fortified towns.

SECTION II.—2. THE WAR OR STAFF SCHOOL (*KRIEGS-SCHULE*).

The Staff School in Vienna has only existed for four years, and is still lodged in a provisional building till the edifice intended for its permanent use is erected. The Institution is one amongst the many institutions for Military Education which were founded soon after the end of the Hungarian war, and to which indeed the experience of the war may be said to have given rise.

A Staff Corps, appointed with great care, has, however, existed in the Austrian army for more than a century, and for many years all the appointments made in it have been dependent upon an examination, which was in fact one of competition.

Earlier mode of entering the Staff Corps.

The process was formerly as follows:—An Officer desirous of becoming a candidate for a staff appointment sent in his name to the Colonel of his Regiment, whose recommendation he was obliged to obtain as a preliminary step. If supplied with this, he began his course of staff study, and was sent for this purpose to some large garrison town as an *attaché* to the Staff. Whilst here he went through, for two years, the course of drawing, writing military memoirs, mapping the country &c., and for two years more served on active Staff duty with different bodies of troops. At the end of these four years a number of the Officers thus employed in a particular country were brought together, and examined by the Chief of the Staff in the country, assisted by a Board of Officers appointed for the purpose. No actual list was drawn out of the order in which the candidates acquitted themselves, but it was understood that the best were chosen and put upon the General Staff. The work upon this was exceedingly laborious; few except Officers of real ability were candidates for it, and patronage in it was looked upon with great dislike. On the other hand, studies and reading were not made the first requisite; a ready intelligence and quick eye to make an Officer a *Colonnen-führer*,—leader of a column on a march,—were always most valued.

Laborious nature of the course of instruction.

It appears, therefore, that an examination and competition for appointments on the Staff has existed for many years in the Austrian service, and the present system only differs from the system above described, which was in force previously to the wars of 1848, in having added the school at Vienna, and having more completely centralized and systematized the examination for appointments.

Staff Corps.

Before describing this school, it may be as well to mention shortly the Staff Corps and the Corps connected with it.

1. The General Staff of the Austrian Army consists of—

Twelve Colonels.
Twelve Lieutenant-Colonels.
Twenty-four Majors.
Eighty Captains.

The *attachés*, to the number of eighty,—*i. e.*, those who are expecting appointments, may be Subalterns, but they obtain the rank of Captain on joining.

The Chief of the Staff Corps is Field-Marshal Hess.

Corps of Adjutants.

2. There has been created very lately a separate Corps of Adjutants or Aides-de-Camp, who are charged with the administrative duties, such as inspecting the bearing, equipment, carrying on the discipline, &c. of the troops. This consists of—

Eleven Generals.
Eighteen Lieutenant-Colonels.
Eighteen Majors.
Fifty-eight First Captains.
Ten Second Captains.
Ten First Lieutenants.

There is no examination for entrance into this Corps. Appointments are made by the Generals, and we were told that there was some scope for "protection."

Corps of Geographical Engineers.

3. There is also a smaller Corps for the purpose of surveying, called the Corps of Geographical Engineers, connected with the Staff, inasmuch as some of the Staff Officers draw the maps on a large scale, which it is the business of this corps to reduce. We have elsewhere mentioned our visit to the institution belonging to this Corps. It is usually occupied on the Great Surveys of the Empire; at present it is employed on the Survey of the Principalities.

It consists of—

One Colonel, called the Director.	Sixteen Captains.
Two Lieutenant-Colonels.	Sixteen Lieutenants.
Two Majors.	Four Sous-Lieutenants.

War or Staff School.

The Staff School consists of thirty pupils taken from all arms of the service, fifteen being received each year, and the course of study lasting two years. It is under the direction of a General and a Lieutenant-Colonel; and, with few exceptions, such as might occur in the time of war, no appointments on the General Staff are to be given to any Officers who have not passed through the Staff School.

Conditions of admission into the Staff School.

In order to enter the School for the Staff Corps, an Officer must have served at least two years with his Regiment, and be unmarried, and above twenty-one and under twenty-six years of age. He may then forward to the Chief of the Staff, through his Colonel, his claim to be admitted as a candidate at the Entrance Examination. Further inquiry is made, and a good many of the names sent in are struck off the list. Such, we were told, was the case last year when the names sent in were very numerous, but out of these only forty-five were allowed to compete, and out of these again only fifteen (the regular yearly number) were selected. The competition for entrance into the School is indeed said to have been very active ever since it was opened. Most of the students are *Neustadters*;* the seven Professors were all, with the exception of the professor of the French language, military men, and chiefly Officers of Artillery, formed in the long studies of the old Bombardier School.

The subjects in which the candidates for admission are examined are—

1. Algebra and Geometry, Plane and Spherical Trigonometry.
2. Geography.
3. History.
4. Arms and Munitions.
5. Field and Permanent Fortification.
6. Pioneering.
7. Rules of Drill and Exercises.
8. Manœuvring.
9. Military Drawing.
10. Military Composition.
11. French.
12. To be able to speak one of the Austrian national languages, and to write a good current and legible hand.

System distinctly competitive.

The most striking features in the system of this School, both at the entrance and throughout the course, are that it is distinctly competitive, that it admits very young Officers, and that while the work is considerable, the subjects for study are not numerous. In these three points it differs considerably from the Prussian Staff School, in which the students are generally older, and the principle of competition is not so fully carried out.

Subjects of Study not numerous.

In the Austrian School, the students are placed on entering in the order which their Entrance Examination has just fixed. They are examined once a month during their stay. On leaving the School, their respective places are again determined, and they have a claim for appointments in the Staff Corps in the exact order in which they were placed on leaving the School.

Their relative places on leaving the School are assigned to them, as we were assured, very carefully, and, after much consultation in every case among the Professors; but this is not done by marks, nor by any minute system of testing intellectual qualifications, but an estimate is formed upon the whole work of the two years, both on the studies in the school and the practice in the field,—of the student's comparative fitness, *as an Officer, for the work of the Staff.* "We try to estimate the whole man," was the expression used to us, "whether he will make a good *Colonnen-führer*" (a good man to direct a regiment on a march), as was said elsewhere. This general estimate was preferred to that of marks, on the ground that the latter might give too much weight to the more appreciable, *i.e.*, simply intellectual qualities.†

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* Young men who have been educated at Wiener Neustadt, the principal Military School for the Austrian Service, the old foundation (as we have mentioned) of Maria Theresa.

† We were informed that during the last two years, two Officers had been obliged to quit, not having sufficient capacity to complete their studies in a satisfactory manner.

The students do not at present live within the establishment, but are to do so when the new ones building are ready. They begin their lectures at half-past seven and end at one or three o'clock on alternate days, going to the riding-school in the afternoon on the days when their morning's work ends at one. Thirty horses are kept for their use.

Subjects of Study; first year.

The subjects of instruction during the first year consist of—

1. Military Drawing and the Study of Ground and Positions.
2. Higher Tactics.
3. Staff Duties.
4. French Language and Literature.
5. Riding.

Second year.

And those of the second year are as follows:—

1. Military Drawing, and the study of Ground and Positions.
2. Military Geography.
3. Principles of Strategy, illustrated by representations of some of the most instructive campaigns.
4. French Language and Literature.
5. Riding.

Employed eight hours daily.

The students are occupied at the school about eight hours daily, and their chief work is military drawing and topography. We went into the room where the students of both years were working together at drawings and plans under an Artillery Officer, said to be one of the best draughtsmen in the Army. Some of the plans were modelled in soap, the *hachures* being marked very elaborately, so that the models and drawings might closely correspond. We also attended a lecture of the second class in military geography. A student traced out on the black board the line of the Western Alps, and was examined very closely on the smaller passes, the rivers, and the bases of operations for armies on both sides. The answers were very minute, and given with the greatest readiness; and we understood the question to be taken at random, and not to be a prepared one. *

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* It may be desirable to give some specimens, taken from the official account of the school, of the questions put at the examinations for admission.

I. *Vivâ voce.*

1. Mathematics:—
   Give an explanation of geometrical series, and a proof of the general formula.
   How is the circumference and area of a circle determined? How are the trigonometrical functions of the different quadrants of the circle indicated?
2. Geography:—
   What is meant by the *backbone* of Europe? what States does it pass through?
   The source of the Elbe; its principal feeders.
3. History:—
   Describe generally the wars of Charles V.
   The political consequences of the Battle of Leipzig.
4. Arms and Munitions:—
   What is the material of sword blades? how are they made and proved?
   How are gun carriages made for field and siege guns?
   What kinds of hollow shot are used in the Austrian artillery, and on what do their effects depend?
5. Field and Permanent Fortification:—
   How is a trench made?
   How is a parapet built?
   What does a front of fortification consist of? what is the disposition of the several lines? what parts protect the principal rampart? what is the form of the flanks? and how is the main ditch made?
   What is meant by detached works? where are they placed?
   What are the best arrangements for the successful defence of a fortress?
6. Pioneer Service:—
   How are two beams of the same dimensions fastened together in the same direction?
   How are suspension bridges put up?
7. Rules for Drill and Exercise:—
   (*a.*) Infantry.
   Wheeling during a march.
   Forming of close battalion column.
   (*b.*) Cavalry.
   Marching in files and fours.
   Forming line from the flank to the front and rear.
   (*c.*) Artillery.
   Intervals and distances in a battery.

II. Paper Work.

In Mathematics:—

1. Prove that in every triangle the square of the one side is equal to the sum of the squares of the two other sides, less twice the product of these two, multiplied by the cosine of the angle they enclose.
2. If the hypothenuse is 33, and one angle 25° 48′ 12″, find the other angle and the perpendicular, &c.

Service with Troops of other Arms.

The student Officers attending the School are called upon to serve in those arms to which they do not belong. For this purpose they join the troops of the garrison of Vienna during June, July, August, and September, and if they belong to the Infantry they go through all the exercises of the Cavalry in one year, and of the Artillery in another. If they belong to the Cavalry, they go in the same manner through the exercises of Infantry and Artillery. After going through this practice, they have to take the command of a battery, of a squadron of Cavalry, and of a division of Infantry.

The month of May is devoted in the first year to an expedition for practice in surveying the country, and in the second, for making reconnaissances, &c.

October is a vacation in the first year. In the second it is taken up with the final examination before leaving.

The Officers acting as Professors receive 600 florins, about 60*l.* annually, besides their pay.

Appointments to Staff Corps in order of merit.

Immediately after the final examination, if there are any vacancies in the Staff Corps, the pupils receive appointments in order of merit, and are at the same time made Captains. In proof of their receiving appointments on the earliest opportunity, we were told by Colonel Scudier that the last ten vacancies in the Staff Corps were filled up out of the twelve students who had just left the School. One of these was only a Second Lieutenant, and in order to make him a Captain, (the rank required for the Staff Corps,) the Emperor promotde him to be a First Lieutenant immediately, and to be a Captain within three days afterwards. This double promotion was on the ground of great merit.

If an Officer finds no vacancy in the Staff Corps ready for him, he must return to his regiment and wait as an attaché. But if a Second Lieutenant, he is entitled immediately to a step of rank, and if a Lieutenant, after three years' service he is made a Captain, although he may not even then be attached to the Staff Corps.

There are to be eighty of these Attachés to the Staff. Their number at present amounts to only thirteen.

With regard to special Aides-de-Camp, Generals are allowed to choose their own, without examination, but with this limitation, the Officer chosen must not be a relation.*

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* The following shows the nature of the Report presented by the examiners upon an Officer examined for admission. It is called the *Prüfungs-Act*, and is sent into the Supreme War Department, that is, to the Fourth Section.

Form No. I. gives the name, age, rank, and length of service of the Candidate (Lieut. R. H.)

Form No. II. :—*a* Oral Examination.

1. Mathematics	Very good.
2. Geography	Very good.
3. History	Very good, knowledge thorough, statements logical.
4. Arms and Munitions	Excellent; acquainted with the very details.
5. Field and Permanent Fortification	Both satisfactory.
6. Pioneer Service	Very good.
7. Drill and Exercise Rules—	
Infantry	Very good.
Cavalry	Not thorough.
Artillery	Good.
8. Manœuvering	Excellent.
9. French	Translates without difficulty from French into German, and German into French. Not much practice in speaking.
10. National languages	Speaks good Bohemian.
b. Paper Work—	
1. Mathematics	&c. &c.
c. Accomplishments—	
Writing.	
Military Drawing.	

Remarks.—Lieutenant R. H. is a pupil of the Neustadt Academy, of much natural talent, and quick apprehension. His way of expressing himself is quick and logical, and shows a clear head. He has a fair military bearing, and prepossessing appearance. He gives every hope of proving a useful Officer of the Staff, and deserves admission into the War School.

Form No. III. gives the questions actually put, as in the note on the preceding page.

(Signed) . . . . . .

SECTION III.—THE CADET INSTITUTIONS.

Object.

The Academics are supplied with pupils from the Cadet Institutions, junior military schools for boys between eleven and fifteen, recently established at four different points in the Empire, Hainburg on the Danube a little below Vienna, Marburg, half way to Trieste, Cracow, and Strass, near Marburg, (this last to be transferred hereafter to Znaim,) these four institutions having taken the place of the lower classes of the old Academy of Wiener Neustadt.

Number.

Each of these contains 200 boys, divided into four classes of fifty each, in accordance with the course of four years.

Studies.

The subjects of instruction are Arithmetic and Algebra, Geometry, and the commencement of Trigonometry, Geography, History, and Natural History, writing, and common Drawing, French and German, a knowledge of which last, however, is not indispensable for admission ; special instruction being provided in the first year for boys who come up from the provinces where German is not spoken. Drill and exercises, and the usual gymnastics and swimming, are of course not forgotten.

The distribution of these subjects is as follows :—

Table of Studies.

Subject of Study.	Numbers of Hours allotted Weekly to each Subject in the different Yearly Courses.			
	1st.	2nd.	3rd.	4th.
Religious Instruction	1½	1½	1½	1½
German Grammar	7½	7½	7½	—
German Speaking	—	—	—	7½
French	3	3	3	3
Arithmetic	7½	—	—	—
Arithmetic and Algebra	—	7½	7½	1½
Geometry	—	—	—	7½
Geography	3	3	3	3
History	3	3	3	3
Natural History	—	1½	1½	3
Writing	4	4	4	4
Drawing	4	4	4	4
Exercises	2	2	2	2
Gymnastics	2	2½	3	3
Totals	37½	39½	40	43

Staff.

A Field Officer, assisted by two Captains and ten Subaltern Officers, two Ecclesiastics, and twelve Sergeants, constitute the staff.

Different classes of Pupils.

The annual charge is 400 florins (40*l.*), but the majority of the boys appear to be *foundationers;* this point is more fully dwelt upon at page 163. The doors of the Cadet Houses are open, it should be remembered, to very promising boys from the Lower Houses of Education, to the extent of two or three annually from each house, but how far this has been successfully carried out we were not informed.

Removal.

Pupils who do not give satisfaction are transferred to the Upper Houses of Education, or at the close of the last year are sent to the School Companies instead of the Academies, application being first made in the case, at any rate, of paying pupils, to their parents or guardians.

The process of gradually eliminating the less desirable pupils appears to be vigorously carried into effect here as elsewhere in the Austrian institutions. The following table shows how a considerable number admitted in the first year (at Hainburg, sixty) had been gradually reduced to forty-two, and to even less at Marburg and Strass.

Number of Pupils at	1st Year.	2nd Year.	3rd Year.	4th Year.
Hainburg	60	54	50	42
Strass	58	—	—	40
Cracow	57	—	—	44
Marburg	60	—	—	41

The calculation of what would be the result of the examinations for *sortie* at the close of the fourth year, was that each school would produce a little more than thirty. It must be remembered, however, that a certain number may be presumed to have left at the end of the second year for the Marine Academy, entrance to which takes place earlier.

The demands of the Academies are thus greater than the Cadet Houses can supply. At the commencement of the year, 120 new pupils (leaving the margin of 20 above the 100 for gradual elimination) would be wanted at Wiener Neustadt, 55 at the Artillery Academy at Olmütz, and 55 for the Engineers at Znaim. For this total of 230 the Cadet Houses would supply scarcely more than 30 each, about 120 in all. The remaining 110 vacancies would therefore be open for applications from boys brought up in the ordinary civilian places of education; and a certain reserved number, together with all that would not be otherwise filled up, would be (in the Artillery and Engineers' Academies) assigned to young men in the School Companies.

The choice of their Academy is offered to the pupils of the Cadet Schools according to their classification in order of merit; only, of course, no very indifferent mathematician would be allowed to go to Olmütz or Znaim.

Visit to Hainburg.

A visit was made to the school at Hainburg, a town near the banks of the Danube between Vienna and Presburg.

The building is very beautifully situated on the lower slope of a detached hill, on the top of which stand the ruins of an ancient castle. The Director, Lieutenant-Colonel Ditz, received us very politely, and took us over the establishment.

We entered, first, the school-room of the first or youngest class. The subject of instruction was French. Several of the boys were brought forward in succession and examined. The Professor was an Officer, as indeed are all the instructors, with the exception of two Ecclesiastics. We next visited the hall of the second class, who were occupied with German. The Professor was an Ecclesiastic, the Chaplain of the Institution. The third class were engaged in drawing, in a very commodious, well-lighted apartment. Some of the drawings exhibited to us were very well executed. The Professor, an Officer, had been originally an artist. We did not see the fourth or highest class in their room, as they were preparing to start the following day for Marburg, there to form the fourth class of the Cadet-Institute newly opened at that place. (The third class was to be furnished from Strass, and the second from Cracow; the first class would enter in the ordinary way.)

There is a small museum, containing a collection of objects of Natural History, principally minerals and stuffed birds.

Great attention is paid here, as in all the Austrian military schools, to gymnastics. We saw a large class go through their exercises in a very active manner. At the close, they mounted on the shrouds and ropes, formed themselves into a sort of *tableau vivant*, and in this position sung together a French military song. The instructor was an Officer.

In the ground floor was the bath-room. The bath was a large sunken reservoir, lined with stone, capable of accommodating a dozen boys at a time. By means of pipes passing overhead, shower-baths could be given. It could be converted into a warm bath in six hours. Each boy has a warm bath once a month. In summer the boys bathe in the Danube close by.

In the upper story of the building are the bed-rooms, one to each class. A Non-commissioned Officer sleeps in each room, in which there is also a man on watch throughout the night, an arrangement which appears to be common to the Austrian Schools. The Cadets rise at five in summer, and at six in winter.

Adjoining the bed-rooms is the "salle d'armes," in which the arms are kept, neatly arranged round the walls. Each boy has a sword, and a tiny musket and bayonet.

Previous to visiting the dining hall we entered the kitchen, where we saw the dinner ready to be sent up. We tasted several of the dishes and found them excellent. The Medical Officer was in the kitchen inspecting the dishes.

Medical Officer.

The dining hall is sufficiently large for all the boys to dine together. They marched in by classes. As soon as all had taken their places, one said grace, making the sign of the cross; the others did the same, and then all sat down.

The hospital, which is in a detached building, was very clean and airy.

The general appearance of the boys was very healthy.

There are twelve Officers in the establishment, of whom eight are employed in the instruction and to maintain discipline.

It was stated that according to the theory of the system, out of the forty boys of which the fourth class ordinarily consists, twenty go to the Wiener Neustadt Academy (Cavalry or Infantry), ten to the Artillery Academy, and ten to the Engineer Academy.

SECTION IV.—THE SCHOOL COMPANIES.

Object and number.

These are the higher institutions for educating young men for the rank of Non-commissioned Officers. The academies which prepare Officers for the Artillery and Engineers receive, as has been seen, in addition to boys from the Cadet Schools, no inconsiderable number of pupils from those School Companies which bear the distinctive epithet of Scientific. These are nine in number, 5 Artillery, 1 Engineers, 1 Pioneers, 1 Flotilla, 1 Marine. It is from these only that pupils proceed to the Academies, and these alone receive young men from the troops who distinguish themselves in the Regimental Schools. The twelve remaining School Companies, being 6 Infantry, 3 Cavalry, and 3 Frontier Companies, also hold out a prospect of promotion to the rank of Officer to the most promising pupils, who on leaving the School may receive the appointment of regimental cadets or candidates; and in general, all the School Companies, it is said in the official regulations, (see page 206) are destined to supply young men who may eventually prove serviceable as Officers with the troops (*Truppen-Officiere*). Nevertheless the immediate and primary object is to provide well instructed Non-commissioned Officers. About one-tenth of the Non-commissioned Officers of the whole Army are furnished, it is said, by the School Companies.

Staff and Studies.

They receive, in accordance with this object, the great bulk of their pupils, in the regular course of annual removal, from the great Schools of the children of Soldiers and Non-commissioned Officers—the Houses of Education. As the Cadet Schools supply the Academies, so do these supply the School Companies. In the Scientific Companies a good many come as *frequentanten* from the troops; in all of them a certain number are admitted direct from places of civil education; and it should be added that the sons of civilian employés are here considered eligible to the free places usually confined to those of soldiers—the military or treasury places.

Each School Company is superintended by a Captain, who has two to three Subaltern Officers and four Sergeants to assist him. All the teachers are either Officers or Non-commissioned Officers. The former remain ten or twelve years, or until they are promoted to the rank of Captain. They receive a salary in addition to their pay. The length of the course varies in the School Companies of the different arms from two to three years. The studies differ in like manner. One subject that appears to be carefully attended to in all alike, is what is called *manipulation*, the mode of preparing official business papers, military reports, &c. &c. Every one is taught to draw up in correct form the proper statement of the despatch, of stores, &c., and the practice is so continual that the young men can hardly fail to arrive at perfect facility and familiarity with the process.

Visits were made to an Artillery School Company at Vienna, an Infantry School Company at Olmütz, an Infantry School Company at Klosterneuburg, and a Flotilla School Company at the same place.

1. *Artillery School Companies.*

Artillery School Company at Vienna.

The Artillery School Company at Vienna contained at the time of our visit 119 pupils and *frequentanten*; the former it appears, are not paid whilst in the School, but are found their food and clothes. This is an exceedingly interesting establishment.

The course of instruction here, as in all the Scientific School Companies, occupies three years, with the exception of those students who are transferred to the Artillery Academy at the close of their second year of residence. As a large proportion of the Artillerymen are Bohemians, that language is taught in the Artillery School Companies. The teaching is carried on by classes corresponding with the years of residence; and the subjects taught and the hours devoted to them during each week of the year are contained in the following Tadle.

ARTILLERY SCHOOL COMPANIES.

SUBJECTS OF STUDY.	Number of Hours allotted weekly to each subject in each yearly course.			
	I.	II.	III.	
	Hours.	Hours.	Hours.	
Religious Instruction *	—	—	—	* An Exhortation on Sundays and Fridays.
Bohemian Language	4	4	3	
Arithmetic and Algebra	7½	—	—	
Geometry	..	7½	—	† It commences with the beginning of March in the third year; one hour and a half weekly are taken from other subjects in which most progress has been made, and are devoted to this.
Practical Mensuration †	—	—	—	
Popular Mechanics and the Elements of Natural Philosophy and Chemistry	..	..	8	
Geography	1	1	—	
History	1	1	—	
Military Correspondence and the Internal Economy of the Affairs of a Battery or Company	4	4	4	
Artillery	4½	4	3	
Elements of Field Fortification	..	1½	—	
Elements of Permanent Fortification and the Attack and Defence of Fortified Places	..	..	2	
Rules and Regulations of the Service	2	2	1	
Drill and Exercises	4	4	4	
Calligraphy	3	2	—	
Military Plan Drawing	4	4	6	
Outline Drawing and Descriptive Geometry	4	4	6	
Grooming Horses, Stable Service, Harnessing, &c.	..	..	2	
Gymnastics, Fencing, and Swimming ‡	—	—	—	‡ Given during the hours of recreation, especially during the evening.
Totals	39	39	39	

The routine of the day is given as follows, in the official papers :—

6 to 7 A.M. Rising, &c., and breakfast.
7 to 8 „ Preparation.
8 to 9½ „ Instruction.
9½ to 10 „ Recreation.
10 to 12 „ Instruction.
12 to 1 P.M. Dinner.
1 to 2 „ A walk, or in bad weather any occupation the students please in the class-rooms.
2 to 5 „ Instruction.
5 to 5½ „ Walking and gymnastics.
5½ to 7 „ Repetition.
7 to 8 „ Recreation and gymnastics.
8 to 9 „ Supper, recreation, bed.

The examinations are entirely conducted by the Professors, in the manner already fully described in the account of the Engineers Academy at Znaim.

We were shown into the various class-rooms or halls of study, some of which would probably contain about fifty students, and of those belonging to the first year of residence two or three were called up, one after another, to answer questions in Arithmetic, Logarithms, involving powers and roots of numbers, Artillery, Geography, and more especially the Military Geography of the Austrian Empire.

We saw the students belonging to the second year of residence, occupied at drawing, principally of subjects relating to Artillery, such as guns, carriages, steam engines, &c., made from measurements of models; many of the drawings were exceedingly well done. Other students were employed in drawing the physical features of ground from models in soap, the models prepared by the students themselves, exhibiting the *hachures* by which the hill shading is exhibited on the Austrian military plans, drawn on the surface, in the same manner that they would be subsequently represented on the hill drawings.

Of the students of the third year, one gave an explanation of the principles and the formula relating to the pulley in mechanics; a second explained the elements of the construction of a front of fortification; a third described the

conformation and construction of horses' teeth. The students, to the number of about thirty, sleep in the several rooms, which are each in charge of a Non-commissioned Officer, who also sleeps in the same room, his bed being screened off from the others. Each is allowed a small chest of drawers. Their ablutions are performed in the passages. They have separate rooms for dining; ten dine at each table; and the Non-commissioned Officers dine together at a separate table.

When the students leave the School Companies at the end of the third year, the best enter into the Artillery as Corporals, others as Bombardiers, and the remainder as Upper Cannoneers.

2. *Infantry School Companies.*

The Infantry School Company at Klosterneuburg.

The Infantry School Companies each contain 120 pupils. The course of instruction lasts for two years, and at its close the pupils who have done best enter the army as Corporals, whilst those who have succeeded less completely carry with them some advantages which distinguish them from privates.

We visited on the same day an Infantry School Company and a Flotilla School Company, both at Klosterneuburg on the Danube, about seven miles from Vienna.

The former is at present established in a building having the appearance of an old monastery, hired from the town for the purpose. It was not on the large scale found in nearly all the Austrian institutions for military education, but it was perfect as regards cleanliness, roominess, and general arrangement. We found in this establishment a personnel of six Professors and Teachers, a Physician, and the Director, all military men.

The subjects of study were—1. Religious Instruction. 2. One or more of the national Languages. 3. The Geography and History of the Austrian States 4. Arithmetic. 5. Elements of Geometry. 6. *Manipulation*, *i.e.* Military Correspondence and management of the internal affairs of a Company. 7. Pioneer Service, including Pontooning. 8. Knowledge of Infantry Arms. 9. Rules and Regulations. 10. Rules of Drill, Exercise, and Manœuvring. 11. Calligraphy. 12. Military Drawing. 13. Gymnastics, Fencing, and Swimming.

The work is unremitting, beginning at six in the morning and continuing till half-past eight at night. There is an interval of two hours, from twelve to two, for dinner and relaxation. A great deal of time was given to *Manipulation*. The Military Drawing appeared to be of an elementary character. Much time is occupied in fencing, gymnastics, and other bodily exercises; and the garden and grounds where these are practised were—as usual in Austrian schools—remarkably fine. The school was marked, as is generally the case in Austrian military schools, by great strictness and regularity in the religious observances.

3. *Flotilla School Company.*

The Flotilla School Company at Klosterneuburg.

The Flotilla School Company we found established in some very handsome barracks, the greater part of which is occupied by the Pioneer Corps (consisting of two regiments) whose School Company is at Tuln, some distance higher up on the Danube. These barracks stood on high ground, overlooking the river, which is here broken into two or three streams, and thus serves as a sort of exercise ground for the pupils of the Flotilla Company and the Pontoneers. We were present at the construction of part of a bridge by the latter in the afternoon.

The Flotilla Service is one peculiar to Austria, and arises from its possessing so many broad rivers, lakes, and the extensive shallows at the head of the Adriatic. For these it maintains *four* flotillas—one for its two great Italian lakes, Garda and Como, a second for the lagoon service about Venice and the north of the Adriatic, a third for the Po and its mouths, a fourth for the Danube. They are considered an important service, and are under the direction of a very distinguished Officer.

We found in this school that a large proportion of the pupils were *frequentanten*, young men who had already been employed as sailors in this service, and had come to perfect themselves as Non-commissioned Officers, and with the hope of higher appointments. A larger proportion here than in the Infantry School Company were *paying pupils*, as distinguished from those who were supported by the State; and it appeared that a large number were made Officers immediately upon leaving the school. As might have been expected from the kind of service, there were many pupils from distant parts of the empire, Hungarians and Italians.

The subjects in which they are instructed are almost identical with those of an Infantry School Company, except that a few higher ones are introduced, such as Trigonometry and popular Mechanics. Maritime Regulations are also taught, and the Illyrian and Italian languages.

We were present at short examinations of the pupils in several of their classes, and with regard to their manner of answering, and to the working appearance and arrangements of the school were as well satisfied as in every other instance of Austrian military education.

Tables of Study for the Infantry and Frontier School Companies.

The following Tables show the arrangement of the subjects of study in the Infantry School Companies, and in those which supply the Militia, so to call it, of the military frontier provinces, in which the whole population is subject to service in arms, and where the whole administration is of a military character.

Infantry School Companies.—Table of Studies.

—	Subjects of Study.	Number of Hours allotted weekly to each Subject in each yearly Course.		—
		1st Year.	2d Year.	
1	Religious Instruction*	—	—	* An exhortation on Sundays and Fridays.
2	A National Language	3	3	
3	Arithmetic	2	2	
4	Geometry	2	—	
5	Geography	1	1	
6	History	1	1	
7	Military Correspondence and the Internal Economy of the Affairs of a Company	8	7	
8	Pioneer Service	—	2	
9	Instruction on the Infantry Arm of Service	1	1	
10	Rules and Regulations of the Service	2	2	
11	Drill, Exercises, and Manœuvering (Instructions relating to)	4	4	
12	Calligraphy	3	2	
13	Military Plan Drawing	6	8	† Given during the hours of recreation, especially in the evening.
14	Gymnastics, Fencing, and Swimming†	—	—	
	Total	33	33	

Frontier School Companies.—Table of Studies

—	Subjects of Study.	Number of Hours allotted weekly to each Subject in each yearly Course.			—
		1st Year.	2d Year.	3d Year.	
1	Religious Instruction*	—	—	—	* An exhortation.
2	A National Language { Wallachian†	3	3	3	† Both languages are only required at the Weisskirchen School.
	{ Illyrian	3	3	3	
3	Arithmetic and Algebra	7	—	—	
4	Geometry, Plane Trigonometry, and Practical Surveying	—	7	—	
5	Geography	1	1	—	
6	History	2	1	—	
7	Military Correspondence and the Internal Economy of the Affairs of a Company	4	4	6	
8	On Fire-arms and Fireworks	2	1	—	
9	Pioneer Service, Roads, and Bridges	—	—	$4\frac{1}{2}$	
10	Elements of Civil Architecture	—	—	$4\frac{1}{2}$	
11	Agriculture	2	2	3	
12	Frontier Law and Administration	—	3	3	
13	Rules and Regulations of the Service	2	2	2	
14	Drill, Exercises, and Manœuvering	3	3	3	
15	Calligraphy	3	2	—	
16	Military Plan Drawing	6	6	6	
17	Gymnastics, Fencing, and Swimming‡	—	—	—	‡ Given during the hours of recreation, especially during the evening.
	Total (at Weisskirchen)	38	38	38	
	Total	35	35	35	

SECTION V.—THE MILITARY HOUSES OF EDUCATION.

Visit to Kuttenberg and Presburg.

Out of the twenty-four Schools established in various localities for the education of young children and boys, from the age of seven to fifteen, for the duty of Non-commissioned Officers, we saw two examples, one the Upper House at Kuttenberg, the second the Lower House at Presburg.

The Lower House at Presburg.

Of the latter little need be said, as it is only as yet in a provisional building, and in a rudimentary condition.

The Upper House at Kuttenberg. Buildings.

The Upper House at Kuttenberg, an ancient Bohemian town not far from the battlefield of Colin, is established in admirable premises in an excellent situation. A large and convenient building, erected by the Jesuits in 1620, in the form of a lapidary F, in honour of the Emperor Ferdinand after his defeat of the Elector Palatine near Prague, which was subsequently converted into barracks, was in 1853 applied to this purpose. A triple tier of massive open corridors gives access to all parts; and the class-rooms, dining-rooms, dormitories, and exercise-rooms all alike were excellent. There is a fair exercise-ground adjoining, on which we saw the boys, all in uniform, and armed with their small muskets and bayonets, muster and go through their exercise.

Numbers.

The number of pupils is in all 198. About one-half come from the nearest Lower House of Education (Josefstadt), the rest from common schools and from their families (these latter, it is said, mostly in a very neglected condition). Out of the 200 places, of which the School consists, 150 are military places; the fifty remaining are held by boys sent upon private or provincial foundations, or paid for by their friends. They enter at eleven and leave at fifteen years of age.

Dismissal

It was stated that the principle of sending away the unpromising boys was freely acted upon. Nine or ten perhaps in one yearly course will be thus dismissed. As they are too young to go at once into the army, the usual thing is to send them in the first instance to learn a trade, after which they join the troops.

Four yearly courses.

The 198 pupils were distributed as follows in the four yearly courses:—

1st year - - -	56
2nd „ - - -	52
3rd „ - - -	40
4th „ - - -	41

Staff.

The Staff was found to consist of one Captain as Commandant, with an Adjutant, and two Lieutenants, six Sergeants as Teachers, eight Corporals for the discipline, and a body of twenty-six or more Privates employed as servants and in mending shoes and clothes, which are made out of the institution.

The Sergeants receive twenty-four florins a month, with an allowance of forty in addition for clothing; after six years good service they receive their promotion as Officers. The Subaltern Officers in like manner, after six years service, are promoted.

Removal to the School Companies.

The boys on leaving are as far as possible allowed to choose the School Company which they or their parents prefer; and it is said to be an object of considerable ambition to be allowed to enter the Scientific School Companies.

The number of the Houses of Education will be reduced.

We were informed that it was the intention of the Fourth Section to recommend the reduction of the number of these Houses of Education. The Upper and the Lower will both be ten instead of twelve; the number of boys between seven and eleven thus maintained will consequently be diminished from 1,200 to 1,000, and that of boys between eleven and sixteen from 2,400 to 2,000.

The annual maximum of boys of sixteen who can thus be supplied by the Houses to the School Companies will therefore be 500.

The official account of the studies is as follows :—

Tables of the Studies.

TABLE OF STUDIES IN THE UPPER HOUSES OF EDUCATION.

SUBJECTS OF STUDY.	Number of Hours allotted weekly to each Subject in the different yearly Courses.				
	1st Year.	2d Year.	3d Year.	4th Year.	
Religion	2	2	2	2	
German Grammar and Composition	8	6	6	6	
One of the National Languages	—	4	5	5	
Arithmetic	6	6	4	4	
Geography	1	1	1	1	
History	—	—	1	1	
Natural History	1	1	1	1	
Rules and Regulations	—	—	1	1	
Rules of Drill	2	2	2	2	
Calligraphy	7	6	4	4	
Drawing	3	2	3	3	
Gymnastics and Swimming*	—	—	—	—	* In the evening.
Total	30	30	30	30	

The ordinary arrangements of the day are much as follows :—

In winter,	6 to 7	A.M.	Rising, &c., and breakfast.
	7 to 10	„	Preparation and lessons, or lessons only.
	10 to 10½	„	A walk.
	10½ to 11	„	Preparation.
	11 to 12	„	Lesson.
	12 to 2	P.M.	Dinner and a walk.
	2 to 4	„	Lessons.
	4 to 5	„	Afternoon meal and walk.
	5 to 7	„	Repetition and gymnastics.
	7 to 8	„	Play and gymnastics.
	8 to 9	„	Supper, play, and going to bed.

The summer routine is much the same. They rise an hour earlier, and get a walk after breakfast, between six and seven o'clock.

TABLE OF STUDIES IN THE LOWER HOUSES OF EDUCATION.

SUBJECTS OF STUDY.	Number of Hours allotted weekly to each Subject in the different yearly Courses.				
	1st Year.	2d Year.	3d Year.	4th Year.	
Religion	2	2	2	2	
German	14*	14*	9	7	* Taught with Writing.
Arithmetic	6	6	6	4	
Geography	—	—	—	2	
Natural History	1	1	1	1	
Writing	—	—	4	4	
Drawing	—	—	1	3	
Elements of the Rules of Drill	1	1	1	1	
Gymnastics and Swimming†	—	—	—	—	† In the evening.
Weekly total	24	24	24	24	

SECTION VI.—TRAINING SCHOOL FOR MILITARY TEACHERS AT WIENER NEUSTADT.

Buildings. This also is one of the recently founded institutions, and is said to have already proved of great utility. It occupies buildings in the immediate neighbourhood of the Château of the Academy at Wiener Neustadt. They are, of course, of a less splendid character, but are clean, commodious, and uniformly good.

Object. The object is to provide teachers for the Military Houses of Education, and Masters of Gymnastics for all the Military Schools and for the troops. The

Two Divisions. School consists accordingly of two divisions, one especially devoted to forming teachers, the other for gymnastics and exercises. Non-commissioned Officers who have served two years, are well reported of, and are unmarried, may be admitted to the one division on passing an examination in the subjects taught in the Houses of Education, and to the other on proving their skill and capacity in Gymnastics.

Staff. The School is under the command of a Field Officer or Captain. Six Subaltern Officers and four Sergeants give the instruction. There is one civilian who gives lessons in the Art of Teaching.

Number. The proper number of pupils is sixty, thirty in each department. We found

Course of Study. thirty teacher-pupils, and about twenty gymnastic pupils present. The course is of one year's duration, but under certain circumstances may be extended to two in the case of the Teacher-pupils. Those who are thus allowed to continue a second year receive instruction in the mathematical subjects taught in the Cadet institutions, with a view to undertaking the office of Inspection-Sergeants, and acting as assistant teachers or *répétiteurs* in these Schools.

Pupils in the Teachers' Department are not expected to show proficiency in all subjects at the examination for admission, and with a view to qualifying themselves in some particular branches, may be excused attending the lessons in others.

The following, however, are considered essential in all cases, and are never dispensed with: the Art and Method of Teaching, German, Arithmetic, Military Composition, Rules and Regulations, and Calligraphy.

The year commences with the 1st of October, the lectures close by the end of July. The examination, conducted in the presence of the Commandant and usually of a Field Officer sent by the War Department, occupies the four first days of August. The remainder of the time is employed in writing exercises and in gymnastics.

Class-room. We were present in the class-room of the Master of the Art of Teaching for some little time. He called up the young men and examined them pretty severely in various subjects in the Art of Teaching in general, in Military Geography, in Arithmetic with the abacus, and in Musketry.

Exercise-room. We were then conducted to the Exercise-room, and saw the young men of the gymnastic department, together with a certain number from the teacher's department, go through a variety of exercises; fencing with foils, swords, and bayonets. There was a single combat with the bayonet and with the sword. General gymnastics followed, in which the young men of the Teacher's Department joined. In the fencing, and some of the more difficult exercises, they are not expected to take part, and about ten of the thirty avail themselves of this dispensation.

All joined in the singing, with which the exercises concluded; the whole closing with "God save the Emperor."

Teachers from the institution have already entered on their duties in several of the Military Schools.

SECTION VII.—BUREAU OF THE GEOGRAPHICAL ENGINEERS AT VIENNA.

Staff.

This Corps consists of:—

1 Colonel as Director.
1 Colonel, Chief of the Geodetical Operations.
2 Lieutenant-Colonels.
2 Majors.
16 Captains.
16 Lieutenants.
4 Second-Lieutenants.

Employment.

It is employed in the geodetical operations connected with the survey of the Austrian dominions, and the surveying, delineation, and engraving of the physical features, and all other details of the country, on the Austrian maps. The trigonometrical operations are understood to be entirely in the hands of this Corps, but a portion of the work of filling in the details and physical features of the ground is allotted to the Officers of the Staff Corps, certain data being supplied to them by the Geographical Department. The Corps is under the supreme command of the General-in-Chief of the Staff, General Hess. It is recruited from Officers of the Army, and at the time of our visit, thirty Officers from different Regiments were under instruction in military drawing, many of whom might eventually be attached to this Corps, or subsequently enter into the War School for the purpose of joining the Staff-Corps. We witnessed the various operations of reducing the plans, preparing the fair drawings, execution of the engraving, lithographing, and both kinds of printing, at this very interesting and celebrated establishment

REGIMENTAL CADETS.

Nomination made by the Colonel or Proprietor of the Regiment.

It has already been said that the very large majority of the Officers in the Austrian Service do not come from the Military Academies. The usual preliminary to receiving a commission is to receive an appointment or nomination as a Cadet in a Regiment from the Colonel, the *Inhaber*, as he is called, or proprietor, the personage of high rank who holds the titular command. The latest regulations for controlling those appointments are contained in Order (*Armee Befehl*) No. XI. of the 22d of October 1850.

Submitted to the consideration of a Board.

The candidate, who must have reached his sixteenth year, addresses himself to the authorities empowered to receive Cadets. After an inquiry into his personal circumstances, and a consideration of his fitness for the corps to which he is named, they may grant or refuse the necessary certificate. If it is granted, the candidate, in the course of the next three months has to present himself at the head quarters of the nearest Army Corps, the authorities of which bring the nominations made during the previous quarter before a Commission of Examiners, consisting of—

The Nominee is then examined by a Board of Examiners.

One Field Officer,
Two Captains,
Two Subaltern Officers.

Subjects of Examination.

The general standard of the Examination is fixed by that of the second year of the fourth class in an Elementary School. That is to say,

1. As regards Calligraphy and Orthography, the candidate must be able to write correctly and legibly, to write from dictation without mistakes, and to write a short intelligible exercise on a simple subject.

2. In Arithmetic the candidate must be able to work the four first rules with ease and correctness, to work fractions, and to apply the Rule of Three.

3. In Geography the candidate must be acquainted with the general geographical facts as to the form of the earth, the quarters of the globe, and the principal countries in each, and must show some exact knowledge of the mountains, rivers, political divisions, and inhabitants of the monarchy.

Favourable certificates from school, produced by a candidate, may be examined by the Commission, and taken into general consideration; but the examination must in all cases take place.

Powers of the Examiners.

The Commission may admit, may give the candidate leave to come up after a year's interval, or may reject absolutely.

Promotion and Instruction.

When a nomination has thus been made and confirmed, the candidate becomes a Cadet. But the length of time which may elapse before he is promoted to be an Officer may vary, according to circumstances, from a few days to years. So long as he remains in the position of a Cadet, he attends one of the regimental schools. There are varieties of these for all ranks in the Austrian army, as will appear from the following official regulations, taken from No. 35 of the Army Order Journal (*K.K. Armee-Verordnungs Blatt.*)

Extracts from Order No. XII. of the 23d of April 1852, relating to Arrangements for Regimental Schools (*Die bei der Truppe abzuhaltenden Schulen*).

Section 1. Officer-Schools.

Regimental Schools for Officers.

The means used for giving education to the Officers are to be oral lectures on military subjects and questions worked out on paper on the matter of the lectures.

All the Subaltern Officers of the regiments and battalions are expected to attend the schools. They are open three days every week for an hour and a half each time, between the beginning of November and the end of April.

Subjects of Instruction.

The instruction includes the following subjects:—

First. Rules and Regulations, with especial regard to the duties of an Officer on detached duty, and to the accounts to be kept and reports made under such circumstances.

Second. Rules of drill, exercise, and manœuvring.

Third. Details as to inspecting arms and taking them to pieces.

Fourth. The language spoken in the regiment.

Fifth. Fencing and practice with fire-arms.

The conduct of the Officer-School is entrusted to a Field Officer, or exceptionally a Captain, qualified for the duties, who will have to give the lectures on the First and Second of the above subjects.

These lectures must not be confined to mere reading out from a book, but must be, for example, in the case of rules for campaigns, in the nature of a discussion on both sides of the various doctrines of the Art of War, accompanied by examples from military history and illustrations from the lecturer's own experience, these being the only means by which interest can be awakened and a stimulus given to thought and private study.

The instruction in arms (Third) is to be given as a rule once every other week by an Inspector of Arms (*Waffen-Officier*), that in the language of the regiment at least twice every week, and must be attended by all Officers who do not know the language. This branch will be taken by a qualified Officer or by the regimental Chaplain. The exercises in fencing will be superintended by an Officer, with a Non-commissioned Officer as fencing-master of the regiment or battalion to assist him. This latter will have to teach the subaltern Officers the sword and bayonet exercise, and to keep them in continual practice, for which purpose they will meet at least twice in every week.

A fencing-room must be provided in every garrisoned place; the purchase and maintenance of the apparatus, and the extra payment to the fencing-master must be supplied by the regiment.

Exercises in practice will take place weekly, with the usual infantry musket, with the rifle, with pistols, and other arms.

If several battalions of one regiment in a station are detached, there need be only a single Officer-School; otherwise there shall be one Officer-School for every battalion, whether of Infantry of the Line, Frontier Troops, or Chasseurs. It is only when battalions are distributed by divisions or companies that these schools may be dispensed with; in such cases military instruction must be imparted by continual conferences formally held by the Captains with their Officers.

In the Cavalry regiments no Officer-Schools will be established, opportunity being afforded in the regimental equitations to send to these any Officers who, apart from instruction in riding, require education in military subjects; lessons will accordingly be given in these on the rules of exercise, manœuvring, and campaigns, regard being continually had to what has been said about the Infantry Officer-Schools.

As regards the written exercises, every Captain and Subaltern Officer, with the sole exception of those in foreign employment (*auswärtigen verwendung*), and therefore considered supernumeraries, are bound to work three exercises, one in summer, and two in winter.

The *theme* (*thema*) is set with due regard to the capacities of individuals, by the Officer of the battalion or division. The subject is to be taken exclusively from matter relating to the rules of a campaign.

The strength of the troops supposed to be employed is, in the case of Captains, one or at the utmost two battalions, one squadron, in the case of Captains of cavalry, from two to four squadrons, one company of chasseurs, and half a cavalry battery; in the case of subalterns of infantry, two companies of infantry, and one half-troop (*zug*) of cavalry, may suffice; and in that of subalterns of cavalry, one squadron with a small detachment of infantry. Each *theme* must have a distinct object and purpose, as on this must depend the correct understanding and solution of it.

The object of these written exercises being the correct application of the rules of war to *a given case*, the ground proposed in them should, as a rule, be in the neighbourhood. The field exercises which are gone through in the course of the summer appear to offer convenient occasion for supplying matter for these questions.

A short military description of the ground should be given at the commencement of every exercise worked out.

To save the trouble of more detailed descriptions, and to give a view at one glance of the distribution of the troops, a sketch (*croquis*) should be attached to each exercise worked out, which, as a rule, should be made from an actual reconnaissance, and only as an exception taken from maps. The scale should be 200 to an Austrian inch.

Fine drawing is, of course, not the thing that is looked for; distinctness and the amount of exactness required for the purpose is the great point. Officers who have no skill in drawing will be only expected to give the direction of the roads, the course of the streams, and the position of the localities, by some simple lines in ink.

The whole must be drawn up by the Officer in question with his own hand, so as to let it be seen how far he possesses a clear style in writing and a legible hand.

The usual form of paper, eight inches broad and thirteen long, shall be used; the sketch is to be exactly of this size.

The exercises worked out by the Officers are to be carefully examined by the Commanding Officer of the battalion or division (cavalry), and noted with his written remarks. These criticisms need not go into minute details; they may be confined to a succinct statement of the principal deficiencies.

These written remarks are of far less consequence than the observations which may be made on the subjects in the schools by the Field Officers, which should not be omitted, and should be attended also by the Captains.

Any exercise which is thoroughly deficient and fails altogether to fulfil the conditions that have been mentioned will be returned to the Commanding Officer of the battalion or division, that he may set another.

The Officers in command of the Regiments must go through all the exercises, and note down their own judgment in writing on the best of them.

The Officers in command of a regiment or a detached battalion submit a general report of all the *themes* done, with a brief judgment on each of them, together with the three best *themes* worked in each battalion (or regiment in the cavalry) to the Brigadiers, who note the most successful exercises of each battalion (or regiment in the Cavalry), with their judgment in writing, and forward them, enclosed with the aforesaid general account, to the Officer in command of the corps.

The Officer in command of the corps gives a final examination, and sends them back each half year with the general remarks issued in the corps orders, those Officers being mentioned by name who have specially distinguished themselves in working out the questions.

A duplicate of these remarks is forwarded, in the form of a brief report, to the War Department.

It is, of course, understood that the Brigadiers, Divisional Officers, Corps and Army Commanders have the power of ordering the production of any of these exercises.

Section 2. Cadet Schools.

Regimental Schools for Cadets.

The object of the Cadet Schools is to educate the cadets to be useful Officers in a company.

With this view, a number of cadets who have already served half a year, not exceeding, as a rule, twenty, will be attached to the company, the Commanding Officer of which has undertaken the Cadet School.

Non-commissioned Officers shall also be admitted to the Cadet School, who, in addition to excellent conduct, have shown any remarkable capacity and justify the expectation that they may be educated for Officers.

The course of instruction is divided into two yearly courses.

Subjects of Instruction.

The subjects are,—

In the first year:—

The Language spoken in the regiment.
Arithmetic.
Calligraphy and Writing from dictation.
Composition on matters of military business, especially all calculations, returns, protocols, &c., required in a company.
Geography and History.
Military Drawing.
Rules and Regulations, Rules of Drill and Exercise.
Fencing, Gymnastics, and Swimming.

In the second year:—

The Language spoken in the regiment.
Elementary Geometry and Practical Surveying (in summer).
Calligraphy.
Military Composition, as before.
Geography and History.
Arms and Munitions (*Waffenlehre*).
Explanation of Military Penal Law and Procedure.
Military Drawing, illustrated by the study of ground, &c. (*Terrainlehre*).
Introduction to the execution of the most usual Pioneer duties.
Rules for Campaigns.
Fencing, Gymnastics, Swimming.

The text books used in the lectures must be exclusively those which are prescribed for the Military Educational Institutions, or which will, in proper time, be announced.

Every one desiring to enter a Cadet School must submit to a previous examination, according to the result of which the candidate will enter, as in the first or as in the second year.

The nomination of any one as a Cadet is subject, it need not be said, to the possession of the amount of knowledge in various branches necessary for admission to the first year's course in the Cadet School, as more exactly stated in Military Ordinance, No. XI.

The Officer in charge of the Cadet School will be assisted in the lectures by two Subaltern Officers, and in superintendence and in the lessons in Calligraphy by two Serjeants.

The necessary number of private soldiers will be placed at his disposal for general attendance and for cooking.

All Soldiers and Officers on duty in the School, with the exception of the Captain, who must continue to carry on the command of his company, are for the time relieved from any other duty. The language of the regiment will be taught by a qualified Officer or the Regimental Chaplain.

Fencing will be taught by the Fencing-master of the Regiment or Battalion.

All the other subjects will be attended to by the Officer in charge of the School and the two Officers placed at his disposal; the subjects being distributed by the Officer in command of the regiment, with due regard to the special qualifications of the Officers of the regiment.

The Examination will be held in September in the presence of all the Field Officers and other Officers of the regiment who are in the place, the Brigadier also being present.

In time of peace only those Cadets will be promoted to the rank of Officers who, in addition to excellent conduct, have passed with success through the Cadet School.

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The pupils will assemble in a separate locality, and will have two rooms arranged for them as class-rooms.

* * * * * * * *

The hours of instruction will be from 8 A.M. to 12, and from 2 P.M. to 5 P.M. daily, with the exception of Saturdays, Sundays, and Feast Days.

On every Saturday the pupils perform the whole duty of standing sentry, &c. (*wach-und sonstigen dienste*), which belongs to the company.

All persons in the Cadet School are in all respects under the immediate orders of the Officer in command of the School, who is under the immediate orders of the Officer in command of the regiment or battalion.

In Cavalry Regiments the Regimental Equitations supply the place of the Cadet Schools.

SECTION 3

Refers to the NON-COMMISSIONED OFFICERS' SCHOOLS, held in each company (or squadron), attended by Corporals, Exempts, Cadets who do not attend the Cadet Schools, and twelve of the most promising Privates. They are open from November to the end of March.

SECTION 4

Relates to SCHOOLS FOR PRIVATE SOLDIERS.

SECTION 5

Relates to the instruction in the duties of Pioneers.

In every battalion there is to be formed a Pioneer School, to which are to be sent one Corporal, one Exempt, and six Privates, including the Carpenters, from each Company.

The School is placed under the direction, in preference, of an Officer who has served in the Pioneer Corps, or who has passed through the course of Pioneering.

The course of instruction lasts from the 1st of November to the end of April, at one hour and a half a day, and embraces the most usual duties of Pioneers in the field. May and June are devoted to practical application of the theoretical instruction previously given.

SECTION 6

Treats of the instruction given in Gun Drill.

Instruction in Gun Drill is given in the station where batteries are quartered; the respective Commanding Officers making the necessary arrangements to that effect.

From every Company and Squadron, eight men are to be selected for this course of instruction. They enter on it the 1st of May, and continue until they are sufficiently instructed. They are then replaced by an equal number of men from the next Company, and so on until the whole of the Companies or Squadrons have been gone through.

From the men thus instructed the detachments named for the protection of the guns (*Geschütz-Bedeckung*) are, in preference, to be taken.

SUPPLEMENTARY DOCUMENT.

No. 1.

TRANSLATION OF THE OFFICIAL ACCOUNT OF THE MILITARY INSTITUTIONS FOR EDUCATION IN AUSTRIA.*

(Vienna, 1854.)

The margin in roman letters is from the original document, that in italics added in translating.

CONTENTS.

General Statements.

I. Schools for Non-commissioned Officers.
  1. The Military Lower Houses of Education.
  2. The Military Upper Houses of Education.
  3. The School Companies.

II. Schools for Officers.
  1. The Cadet Institutions.
  2. The Military Academies (Wiener Neustadt, the Artillery and Engineers Academy, the Marine Academy).

III. Special Schools.
  1. The Training School for Military Teachers.
  2. The Artillery and Engineers Higher Course.
  3. The War or Staff School.

Control of the Institutions.

On the Imperial Institutions for Military Education in General

The Imperial Institutions for Military Education are divided into Three Classes. Classification of the Institutions.

They are—

I. Such Institutions as are immediately intended for the education of pupils as Non-commissioned Officers; namely, *1. Institutions for educating non-commissioned Officers.*
  (1.) The Lower Military Houses of Education.
  (2.) The Upper Military Houses of Education.
  (3.) The School Companies.

II. Institutions in which it is intended to educate pupils as Officers; namely, *2. For educating Officers.*
  (1.) The Cadet Institutions.
  (2.) The Military Academies.

III. Such Institutions as partly give a special kind of instruction, and partly complete and carry out the previous education of Officers. These are— *3. For special instruction.*
  (1.) The Institution for Military Teachers.
  (2.) The Higher Course for the Artillery and Engineers.
  (3.) The War School.

The Appendix No. 1.† contains a general representation of the manner in which the Institutions for Military Education are connected with each other, together with the names of the places in which they are established.

In the institutions of the first and second class, education as well as instruction is given, but those of the third class are limited to instruction; accordingly, all that is said in the following pages with regard to the admission of pupils, and with regard to beneficial foundations, has no reference to institutions of the third class.

Although each of the first-named classes forms a complete whole in itself, yet they stand in close mutual relation to each other, inasmuch as the most distin- *The pupils of the lower institutions may pass into the higher; and those of the higher be sent down to the lower.*

* *Die Kaiserlich-Königlichen Militär-Bildungs-Anstalten, mit besonderer Rücksicht auf die Vorschriften für den Eintritt in dieselben, Zusammengestellt aus den allerhöchst sanctionirten Reglements der Militär-Bildungs-Anstalten. Wien*, 1854. (The Imperial Military Institutions for Education, with special reference to the conditions required for admission, compiled from the regulations sanctioned by His Majesty.) Vienna, 1854.

† See at page 218, the coloured lithograph.

guished pupils of the Lower Houses of Education pass into the Cadet Institutions; and in the same way the most distinguished scholars of the Scientific* School Companies, viz., those of the Artillery, Engineers, Pioneers, Flotilla, and Marine Schools, may be transferred as attendant pupils† to the Academies; by this means they may obtain a right to a position in the Army as Officers.

So, on the other hand, insufficient progress may be a reason for scholars being removed from the Cadet Institutions and the Academies into the Upper Houses of Education and the School Companies.

By these regulations a road is opened for the advancement of any talent that may gradually develope itself; and at the same time the pupils of the Institutions for Higher Military Education are submitted to that process of elimination which is requisite for the success of these Institutions.

Various kinds of Pupils.

The pupils in the Institutions for Military Education are either foundation pupils‡, or paying pupils; the first are divided into the military or treasury foundation pupils, and the provincial and private foundation pupils.

Pupils on military foundations.

The military or treasury places belong to the army; the claim for these depends upon the nature of the institution and the position of the parents. As a general rule, it may be laid down that children of officers are expected to remain up to eleven years of age under the care of their parents, whereas those of common soldiers may in the eighth year of their age be taken under the protection of the State.

Pupils on provincial or private foundations.

The provincial foundations are bestowed upon the sons of the nobility, or of distinguished *employés* of the State belonging to the crown lands of the province. Private foundations are those established by private individuals or corporations, and the appointment to these depends upon the conditions laid down by the founder. The capital or property of these foundations is generally administered by the Supreme War Department.§

Pupils who pay for themselves.

Every Austrian subject may claim admission as a paying pupil, if the other conditions of admission are fulfilled in his case.

Large number of foundation places. See Supplement No. 2, p. 219.

In the Lower Houses of Education there are only military or treasury places.

In the Upper Houses of Education there are 1,800 military places; the remaining 600 are filled up by pupils upon provincial or private foundations, and by paying pupils.

In the School Companies the number of the foundation places and paying places is not fixed.

In the Cadet Institutions and the Academies there are 900 full and 200 half military places, and 520 places for pupils on provincial and private foundations, and for paying pupils.‖

The Appendix No. 2. contains an account of the whole number of places, both provincial and private, in the Institutions for Military Education.

Payments, *from 15l. to 80l. a year.*

A sum to cover the expenses is fixed in the case of the pupils on the provincial and private foundations, as also for the paying pupils, amounting in the Houses of Education and in the School Companies to 150 florins (15*l.*) per annum; in the Cadet Houses to 400 florins (40*l.*) per annum; in the Academies 600 florins (60*l.*) for each of the three first years, and 800 florins (80*l.*) for the last year. These payments will be subject to modifications, at considerable intervals of time, according to the price of articles of consumption, and will be drawn in the case of the pupils on the provincial foundations from the funds of the respective provinces, and in the case of the pupils of the private foundations, from the monies belonging to the private foundations.

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* *Technische* (technical) is the original word. Compare its use in another matter; there are in the Artillery two services, the ordinary Campaigning Artillery and the *Technical* Artillery.

† *Frequentanten*, who frequent, attend, or visit the school.

‡ *Stiftlinge*, foundationers, and *Zahlende*, paying pupils, the first divided into, (1.) *Militär-Ärarial* foundationers, who are, as a rule, sons of Soldiers and Officers, and are maintained at the expense of the Military Treasury, the *Ärar*, or *Ærarium:* (2.) Provincial foundationers, who are maintained by the interest of lands or money granted in favour of young men belonging to some particular province, Bohemia, Gallicia, the Tyrol, Upper or Lower Austria, either by the Central Government (the State), or by the Estates or Parliament (*Stände*) of the province: (3.) Private foundationers, under which name are included not only those maintained by monies left by private individuals, but those also whose payments come from grants made by municipal and local corporations.

§ The *Ober-Militär Commando*, or *Commandership-in-chief*, the Fourth Section of which has the charge of Military Education. *Commando* is the German word corresponding to Commander, as *Ministry* does to *Minister*, and may signify one or more persons, a single Officer, or a Board of Commissioners.

‖ Making a total of 1,620, to which may be added about 80, reserved for *Frequentanten* from the School Companies; the number will then correspond with those given in the Appendix No. II.

The capital for the provincial and private foundations must be duly secured and sufficient in amount to cover the fixed payments for the number of places determined upon. Supposing the sum contributed to be insufficient, the requisite sums must be obtained by deferring any further nominations.* The proper sums in discharge of these contributions must be paid in advance, half-yearly, on the 1st of October and the 1st of April. Those which belong to the provincial foundations, and such private ones as are administered by trustees, must be paid into the nearest Military Chest.† In the case of those pupils who pay for themselves, the money must be sent precisely on the above-mentioned days to the Commandant, or Director of the School, without reference to the day on which the pupil may have entered the school. On the other hand, in cases where a pupil either is removed from or otherwise quits the institution before the natural time, restitution will be made of the corresponding proportion of the sum paid in advance.

General Conditions of Admission.

For admission into a Military Educational Institution, the boy must first of all be of the age specified for the institution in question, and must further possess the proper bodily growth and strength corresponding to that age, and the prescribed amount of knowledge. Every boy who is to be offered as a candidate for a military place must first be registered, and this in the course of the same year for which his admission is desired. This registration must be made by the parents or guardians through the Commanding Officers of the Army,‡ or Army-Corps, or Military Government§ within whose district they are domiciliated, or in case of their living in foreign parts, through the Austrian Legation of the country.

Certificates of baptism, health, and conduct.

Applications thus made must state what is the institution, admission into which is desired, and must be accompanied by the following certificates:—1. Baptismal certificate. 2. Certificate of vaccination. 3. Certificate of bodily health, by a Military Surgeon. 4. The school certificate for the last half-yearly examination: And 5. On the reverse the following declaration:—

Declaration of surrender to the military service.

"I hereby pledge myself to surrender up my son (*or* ward) to the Imperial "Military Service, in case of his being admitted into a Military Educational "Institution; and I declare that I will under no pretext require his return."

The object of this declaration is, on the one hand, to secure permanent elements for the Military Educational Institutions, and to create in the minds of the relations of the candidates the seriousness of purpose so essential in the choice of a profession. The declaration will also serve to retain the pupils to a course, which they have usefully commenced, and to protect them from the consequences of hasty decisions on the part of their friends. On the other hand, if it appears manifest that a pupil has not the requisite inclination or qualification for the military service, his removal from the institution ensues with or without the request of his friends, as will be more fully explained further on.

The applications will be examined by the Commanding Officers of the Army, or the Army Corps, or military government, and after their revision the candidates will be registered and the petitioners duly informed.

Any changes which occur in the case of the registered candidate, or in his family circumstances, between the time of registration and of actual admission, are to be made known to the authorities before whom the application was brought.

The registers are to be submitted to the Supreme War Department in the middle of June, so that applications can be received by the Commanding Officers of the Army, or Army Corps, or Military Government, at the utmost only up to the end of May.

Appointments to Military Places in the Schools.

Appointments to the military places in the Houses of Education and the School Companies are made by the Supreme War Department; His Majesty the Emperor reserves for himself those in the Cadet Institutions and the Academies.

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* The interest, that is, will be allowed to accumulate, until a sufficient sum is provided to pay for the maintenance of a pupil.

† Such as exist in most large towns.

‡ There are four *Armies;* the First in the west, with its head quarters at Vienna; the Second in Italy, with its head-quarters at Verona; and two others in the eastern provinces. Each of these is divided into a certain number of Army-Corps. The particulars may be seen in Schematismus or Military Calendar, and briefly in the Almanach de Gotha for 1856, p. 306.

§ In those parts of the Empire, namely, in the so-called Military Frontiers, the old Turkish border, where the government is simply military. Compare the account of the studies required in the Frontier School Companies.

Appointment of Pupils from Provincial,

Vacancies in the provincial foundation places are advertised, and applications called for, by the Governors or by the Standing Committees of the Estates of the respective provinces.*

All proposals made in this manner are forwarded to the Minister of the Interior, and submitted by him for the sanction of His Majesty.

and from Private Foundations,

Appointments to the private foundations are made by the person specified by the founder; decisions of this kind are submitted on or before the 15th of June to the Supreme War Department for their approval of the candidates and distribution of them into the various institutions.

If a candidate in whose case the prescribed conditions of admission are not fulfilled is nominated to a private foundation, and his nomination consequently not approved, a new nomination must be made.

and of Pupils who pay.

Pupils who pay are appointed by the Supreme War Department.

Announcement.

The sanction of the appointments and the distribution of the candidates appointed in the various institutions, in the case of the military and the paying pupils, will be made known to them by the Commanding Officers of the Army, or Army Corps, or Military Government; in the case of the provincial foundations by the Minister of the Interior; and in the case of the private foundations by the trustees.

Candidates living in a foreign country will be informed by the Legation in that country.

Upon the appointment made to an entirely gratuitous place in a military educational institution, all payments of allowances for the education of children cease.†

Conveyance.

The conveyance of military foundation pupils to the school to which they are appointed will, if not provided for by the friends of the pupils, be made at the expense of the Military Treasury by the ordinary means of locomotion.

Trustworthy Non-commissioned Officers from the nearest detachment of troops should be selected by the military authorities for the conveyance and charge of the pupils; four or five being, according to the circumstances, committed to the care of a single superintendent.

The conveyance of all other pupils must be provided for by their friends.

Entrance.

Admission into the Military Educational Institutions takes place only at the commencement of the school year. Candidates admitted must present themselves in their respective institutions between the 15th and the 30th of September.

The Commanding Officers of the Army, or Army Corps, or Military Government have to take care that every candidate admitted to a military place shall, before leaving to join the institution, be a second time examined by an Army Surgeon, and shall only be allowed to proceed to the institution in case of his bodily qualifications being found perfectly sufficient.

Finally, the candidate upon presenting himself must be re-examined by the chief Medical Officer of the institution, and if he is hereby found to be unqualified for military education, will not be received.‡

Any Military Surgeon or Medical Officer who incurs the guilt of neglect of his duty in this particular will be held responsible.

Every candidate is examined for admission.

Every candidate upon presenting himself will moreover undergo the prescribed examination in his previous studies, and if his previous education appears insufficient, his appointment will be cancelled.§

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* The Governor or Lord Lieutenant (the *Statthalter*) is the ordinary representative of the Emperor in the various provinces composing the Empire. In his hands resides the usual administration of the government. The provinces have also their ancient Estates or Parliaments, Standing Committees of which might, under certain circumstances, sit at times when the Estates were not assembled.

† Small allowances, *e.g.* of 8*l.* for three years, are very generally made to the widows of officers, and occasionally to officers themselves, to assist them in securing a decent education for their children.

‡ Thus, it will be seen, all candidates appointed to the military places in the schools are examined three times over by a medical officer. Where the State does not pay, in the case of provincial or private foundations, or of paying pupils, the same amount of precaution is not thought necessary.

§ The difficulties of travelling appear to be considered in Austria too great to allow of any examination (competitive or otherwise) before the candidates provisionally admitted actually arrive at the school to which they are appointed; if ill qualified, they are dismissed with the chance of a second trial.

Pupils admitted after a private education into a Military Institution are provided by this institution with new linen and clothes. All clothes they bring with them are without exception to be returned to their friends, and an acknowledgment of the return given. *Clothes, &c., supplied.*

No pupil in any of the Military Institutions is allowed to possess any linen or clothes except what is provided; and the friends and relations are not to be called upon for any sort whatever of additional contribution. An amount of pocket-money, varying with the character of the institution, may be transmitted to the pupils through the hands of the authorities of the school; but this is entirely at the pleasure of the friends and relations; all necessaries being provided by the institution. *Pocket money.*

The pocket-money can only be paid to the pupil through the Commanding Officer of the Institution or of the Company.

The amount allowed must depend on the conduct of the pupil, but must not, even in the Academies, exceed three florins (six shillings) a month.

The course of instruction given in the Military Educational Institutions is fixed by special tables drawn up for each institution. Special text books, to be followed in the courses, are also appointed. Instruction.

The tables drawn up to regulate the course of instruction are subject to such modifications as may be called for by the requirements of science and by improvements in the methods of teaching.

The scholars will also receive in the course of the year, more particularly in summer, and after the close of the examination, practical instruction suitable to the arm of the service for which they are destined.

Every September the pupils pass into the next succeeding yearly course.

In the same month the scholars quit the institutions, and are either placed in the army or transferred to other institutions. The conditions under which this is done are given in detail in the account of each institution. Removal and Promotion *This takes place in September every year.*

The expenses of the conveyance of the pupils from one institution to another are borne by the Treasury.

Pupils who make no progress in scientific studies will be required to enlist in the army * if old enough, and if not, will be removed to an inferior Military Educational Institution; or if they are already in one of the Houses of Education or School Companies, will be employed in learning some trade which will be of use in the army,† and when they have reached the proper age, will be enlisted. *Those who do not make progress are sent to an inferior school, or if old enough, to the army.*

Pupils whose want of bodily qualification unfits them for the army will be sent back to their parents or guardians. Those holding military places in the Academies, if their parents are entirely unable to provide for them, will receive a yearly pension of 150 florins (15*l.*) until they can be placed in some employment under the State at a salary at least equivalent to this sum.

Pupils out of the Military Houses of Education or School Companies, who are removed for want of bodily qualification, and whose parents are entirely unable to provide for them, will, according to their capacities, be placed either in the Accounts Department ‡ or some similar Military Department, in the Geographical Institution, or as drummers or clerks in one of the higher Military Schools, or will be taught some trade for employment in the Outfit Department,§ or will be made teachers. If, however, the pupil's bodily disqualification be of a nature to incapacitate him for any of the above-mentioned employments, he will be removed at the expense of the Treasury into some Civil or Military Hospital.‖

If in moral respects a pupil is found to be a mischievous member of the institution, he may at any time in the course of any year be removed. *Removal for misconduct.*

Pupils who pay, in case of their removal being found, for whatever reason, necessary, will be sent home to their friends, the consent of the friends being required before they can be either engaged as soldiers or removed to one of the

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* Will be *assentirt*, will take the oath. They are considered old enough for this at sixteen.

† Even clothes and shoes being made by soldiers; a considerable number of soldiers were found thus employed, for example, at the Artillery Academy at Olmütz, under the superintendence of a master workman, bearing a non-commissioned grade, that of a *prima-planist*, for whom, *see* a Note further on.

‡ *Militär-Rechnungs Branche.*

§ *Monturs Commission*, charged with the duty of providing arms, clothing, &c. for the army. There are several establishments in various parts of the Empire. One of the largest is at Stockerau, near Vienna.

‖ Into a *Siechen-haus*, a hospital for incurable cases; or an *Invaliden-haus*, for *Invalides.*

Pupils once removed, for what ever reason, are never re-admitted; and if they enter the army cannot be made Officers before the pupils of that year.

lower institutions. The expenses already incurred will be deducted from the payment made in advance, and the balance repaid to the parents or guardians.

A pupil who for whatever reason has once been removed from a Military School can never be afterwards admitted into any one of them, and in case of his either then or afterwards enlisting in the army, he cannot, under any pretext whatever, obtain the rank of Officer before the pupils of the year to which he belonged. This rule, in the case of pupils who have been transferred from a higher to a lower institution, even when they pass out of this latter in the regular course, must be observed in reference to the pupils of the year to which they belonged in the institution from which they were removed.*

I. Schools for Non-commissioned Officers.

1. *The Lower Military Houses of Education.*

The general object.

The twelve Lower Military Houses of Education contain, as has been said, only military places.† These appertain, in the first instance, to the legitimate sons of all soldiers bearing arms,‡ whether born in marriage of the first, or in marriage of the second degree.§ Subordinately to these, a lawful claim exists in the following cases:—

The Lower Military Houses receive only the sons of soldiers, at the cost of the State.

1. Sons of soldiers serving in the Trabant Body Guard, the Court Watch, the Outfit Commission, and other military bodies.‖
2. Sons of fathers belonging to the Reserve,¶ without prejudice, however, to sons of soldiers in actual service.
3. Sons of invalided soldiers,** not only in cases where the father has already married at the date of his reception as invalided, but also in those where marriage has been subsequently permitted.
4. Sons of those who have either as substitutes or otherwise served double time, and are now in employment in connexion with the Court or Government, even in cases where marriage has been contracted after quitting the service.
5. Sons of men belonging to the military service, not included in the above-mentioned cases, namely, the sons of Prima-planists,†† Employés, and Officers.

In any large number of candidates special regard should be had to the sons of fathers who have been killed or invalided on the field; after these, to those who are orphans on both sides; then to the sons of substitutes and other soldiers in actual services; and last follow in order the sons of fathers either belonging to the Reserve or received as Invalides, or otherwise connected with the Military Service.

Sons of Officers are not admitted to the exclusion of the sons of soldiers.

As the sons of Officers serving with the sword ‡‡ have a large number of places reserved for their benefit in the Cadet Institutions and the Academies, their admission into Military Houses of Education, more especially into the Lower

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* A pupil who was removed from the Academy at Wiener Neustadt might, for example, enter the army as a simple Cadet, under the patronage of the Colonel of a regiment, and might, but for this rule, receive rapid promotion, and become the senior in rank of his comrades of the same year at the School. In like manner, a pupil removed from a Cadet Institution and transferred into a School Company, might, upon leaving that, under certain circumstances, outstrip his late comrades at the Cadet Institution.

† That is, all the pupils are of military or quasi-military birth, and the expense is borne by the State. Both these and the Upper Military Houses are to be reduced, it is said, to ten.

‡ The whole body (*Mannschaft*) of soldiers bearing arms (*Feuergewehrstand*).

§ Marriage of the first degree is that entered into with full permission. In this the wives live in the barracks, receive a certain amount of rations, their children are recognized, and in case of the father's death are admitted into the Orphan Schools. Soldiers are, however, occasionally allowed to marry, on condition of surrendering every claim to the above-mentioned privileges. This constitutes marriage of the second degree.

‖ The *Trabanten-Leibgarde* and the *Hofburgwache* are Court troops. For the *Monturs Commission*, see a previous Note.

¶ Soldiers enlist for eight years, and after this to the end of the tenth year are on the Reserve.

** That is, belonging to the Hospitals or Hotels des Invalides, the *Invaliden-häuser*, of which there are several.

†† Prima-planists, a name derived from *prima plana*, the first leaf of the list, is given to soldiers employed in various special duties, especially perhaps those not of a strictly military kind. The master tailors, master shoemakers, master farriers, are all *prima-planisten*. The surgeon's assistant ranks as such. The grade is superior to that of sergeant, but those who hold it are excluded from promotion to a commission.

‡‡ This is a frequent phrase (*mit dem Degen dienende*) for active service.

House of Education, is only allowable when no prejudice is caused to the above-mentioned claimants, and as a general rule can only take place when they are orphans, or under special circumstances.

The age of admission is seven years, children under that age are sent to the Orphan House.

The age of admission is the completion of the seventh year. Children under this age who are orphans on both sides, or whose fathers being widowers, have to serve in the field, will be received into the Orphan House at Vienna, and be transferred on completing their seventh year to the Lower Houses of Education. Children who have passed the prescribed age for admission into the first class of the Lower Houses of Education can only be admitted, in case of their possessing the requisite amount of knowledge, into the classes corresponding to their age, and in case of there being places vacant in these classes; any addition to the prescribed numbers in the respective years is not allowable.

Number 1,200.

The number of pupils in each of the Lower Houses of Education is fixed at 100. These 100 pupils are divided into four years, each year being as nearly as possible of the same numerical strength.

Officers and teachers.

The command is held by a Subaltern Officer, to whom are attached for the religious education, the medical care, the discipline, and the instruction—

1 House Chaplain,
1 Army surgeon,
4 Sergeants as Instructors,
4 Honorary Sergeants * as Assistant Instructors,
1 Sergeant, as House Adjutant; and
6 Corporals, for the discipline.

Additional assistance may be procured for managing the house and attending on the pupils.

Subjects of instruction.

To conduct the instruction (which will be almost entirely addressed immediately to the senses of the children) class-teachers will be provided for each yearly course; and these, with the house chaplain and the medical officer, aided by assistant teachers, will give the pupils instruction in the following subjects:—

1. Religious knowledge. 2. German. 3. Natural History. 4. Geography. 5. Arithmetic, both ordinary and mental. 6. Writing. 7. Common Drawing. 8. First Notions of the Rules of Drill. 9. Gymnastic Exercises and Swimming.

2. *Upper Military Houses of Education.*

General object.

These, twelve in number, form a continuation to the Lower Houses of Education, the pupils from which are admitted here at the close of their eleventh year.

Pupils at twelve years old come from the Lower Houses, or from elsewhere.

At this age foundation pupils of every kind, as also paying pupils, may be admitted immediately from their parents' homes, only, however, into the first year's course, and after passing an examination in the subjects taught in the Lower Houses of Education, to the same extent up to which they are taught in the second class of the ordinary (*normal*) school.†

The claim to a military place in an Upper House of Education is similar to that for a military place in a Lower House of Education.

Number 2,400.

The number of pupils is fixed at 200 in each Upper House of Education, divided in like manner into four yearly courses.

Officers and teachers.

The command is intrusted to a Captain, who is aided, for purposes of instruction and superintendence, by—

2 Subaltern Officers.
1 House Chaplain.
1 Army Surgeon.
1 Surgeon's Assistant.
4 Sergeants as Teachers.
2 Honorary Sergeants as Assistant Teachers.
1 Sergeant as House Adjutant.
8 Corporals, for discipline.

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* *Feldwebel*, Sergeant; *qua Feldwebel*, Honorary Sergeant, with the title and distinction in the uniform, but without the pay.

† The *Normal Schule* are in Austria the regular elementary, primary, or village schools.

Additional assistance may be procured for managing the house and for attendance, upon the same scale as in the Lower Houses.

Subjects of instruction

The instruction, as in all the Military Schools to be noticed henceforward, will be given by teachers specially assigned to each subject, and will include here the following subjects :—

1. Religious Knowledge. 2. German, with written compositions. 3. One of the other Languages of the Empire. 4. Natural History. 5. Geography. 6. History. 7. Arithmetic. 8. Military Rules and Regulations. 9. Rules of Drill, and first notions of the Rules of Military Exercise. 10. Writing. 11. Common Drawing. 12. Gymnastic Exercises, Single-stick,* Swimming.

After completing their fourth year course, the pupils are transferred, according to their qualifications and their own wishes, into the School Company.

Entrance into the Marine School Company takes place at the end of the second year's course.

3. *The School Companies.*

The general object is to furnish well educated Non-commissioned Officers.

The School Companies have the object of furnishing the different arms of the service with Non-commissioned Officers well educated, both practically and theoretically, and likely in the course of time to prove useful Commissioned Officers† in charge of the troops.

Twenty in number.

They are in all twenty in number :—

6	for the	Infantry.
3	„	Cavalry.
2	„	Frontier Troops.
5	„	Artillery.
1	„	Engineers.
1	„	Pioneers.
1	„	Flotilla.‡
1	„	the Marine Service.§

Under the general term of School Companies the School Squadrons (for the Cavalry) are included. The term Scientific‖ School Companies applies only to those of the Artillery, Engineers, Pioneers, Flotilla, and Marine.

The two kinds of Scholars, Pupils and Attendant Pupils.

The scholars in the School Companies are either Pupils or Attendants.¶ The Pupils are taken, as already described, from the Upper Houses of Education, after the close of their fourth year's course, (or, in the case of the Marine School Company, after that of the second,) or they come direct from places of private education.

Admission to the military places is granted to the sons of civil servants as well as soldiers.
Age 15 to 18.

The conditions for gratuitous admission from private educational institutions into the School Companies are similar to those for admission into the Houses of Education, with the difference, that in the School Companies the sons of officials in the civil service, who have served long and meritoriously, and are ill-provided for, may also claim military places.

The candidates must be not under fifteen and not above eighteen years of age; in the Marine School Company not under thirteen and not above fourteen.

The Attendant pupils (*frequentanten*) come from the soldiers of the Standing Army.** They exist only in the School Companies of the Artillery, Engineers, Pioneers, and Flotilla; to be admissible, they must, as a rule, have passed with credit through the Non-commissioned Officer Schools of the Artillery or Engineer regiments, or of the Pioneer Corps or Flotilla Corps; they must have

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* *Stock-fechten*, or staff-fencing; a sort of military single-stick, the staff used resembling a musket and bayonet in one piece, all of wood.

† *Truppen-Officiere.*

‡ For service on the Lower Danube, the Po, and the Italian Lakes and Lagoons.

§ Both for service in the Fleet and in the Coast Defences.

‖ *Technische*, Technical or Artificer Companies.

¶ *Zöglinge* and *Frequentanten.*

** The *Mannschaft-stand* is a term used to mean the whole body of Private Soldiers and Non-commissioned Officers.

been not more than two years in the service; and not at the utmost be above the rank of an Upper Canoneer, an Exempt, or an Upper Pioneer.*

The admission of Attendants (*frequentanten*) can only be allowed without prejudice to the claims of candidates from the Upper Military Houses of Education and from places of private education.

Pupils who come direct from private education must, if they propose to enter one of the Scientific School Companies, be at least 4 feet 10 inches;† if one of the other School Companies, at least 4 feet 8 inches high. And these and the Attendant pupils alike must at their entrance into the School Companies pass an examination in the subjects of instruction taught in the Upper Houses of Education.

Knowledge of German is required.

A perfect knowledge of German is accordingly an indispensable condition for reception into the School Companies, and can only in the single case of the Marine School Company be under certain circumstances overlooked.

The pupils take the military oath.

At his entrance into the School Company every pupil takes the military oath, and is from this day bound to eight years' service in the Standing Army and two years' service in the Reserve.

Each School Company is commanded by a Captain; each School Squadron by a Captain of Cavalry.

Officers and teachers.

They have attached to them, for purposes of instruction and discipline,—

In each	Infantry School Company	3 Subaltern Officers.
„	School Squadron	3 „
„	Frontier School Company	6 „
„	Artillery „	6 „
In the	Engineer „	6 „
„	Pioneer „	6 „
„	Flotilla „	4 „
„	Naval „	4 „

Each institution is provided also with four Sergeants as teachers, together with a requisite number of additional persons required for management, discipline, and service.

Religious superintendence and instruction is intrusted to a local Ecclesiastic, and the medical duties to an Army Surgeon.

Subjects of instruction,

Scholars in the School Companies are to receive a practical as well as a theoretical training. This is to be regulated according to the branch of the service for which they are detained.

in the six Infantry School Companies, containing each 120 pupils;

Each of the Infantry School Companies consists of 120 pupils, divided into two years, the subjects of instruction being,—

1. Religious Knowledge. 2. One of the National Languages. 3. Geography and History of the Austrian State. 4. Arithmetic. 5. Elements of Geometry. 6. Military Correspondence and Management of the Internal Affairs of a Company.‡ 7. Pioneer Service.§ 8. Knowledge of the Arms of the Infantry. 9. Rules and Regulations. 10. Rules of Drill, Exercise, and Manœuvring. 11. Calligraphy. 12. Military Drawing. 13. Gymnastics, Fencing, and Swimming.

After the close of the course the pupils who have done remarkably well enter the Infantry as Corporals, the pupils who have done well as Exempts, with the Corporal's badge; those who have done moderately, as Exempts; and those who have done either remarkably well, or well, will be, without further ex-

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* The Non-commissioned Officers in the Austrian service rank as follows:
In the Infantry, Corporal, and Sergeant (*Feldwebel*):
In the Cavalry, Corporal, and *Wachtmeister*:
In the Artillery, Corporal, and *Feuerwerker*:
But there are distinctions in addition. A private soldier who is exempted from certain duties, *e.g.* from standing sentry, bears the name of *Gefreite*, or Exempt, in the Infantry and in the Engineers; the corresponding rank to which in the Artillery is an Upper Canoneer (*Ober-Canonier*), and in the Pioneers, an Upper Pioneer (*Ober-Pionnier*). These are in no case Non-commissioned Officers, though in the way to become so. There are also Vice-Corporals (Lance Corporals), with the badge but without the pay of Corporals, and *qua Feldwebels* or Honorary Sergeants, with the badge but without the pay of Sergeants.

† The Austrian foot or shoe (*schuh*) of 12 inches (*zoll*) is a little longer than the English. 80 Austrian make 83 English.

‡ *Manipulation.* See the account of the visits to the School-Companies.

§ This includes pontooning.

amination, named as Cadets* as soon as they pay down the sum required for outfit, or prove their legitimate claim to exemption from this outlay, they themselves being consenting parties.

in the three School Squadrons, containing each 60 pupils;

The arrangements of the School Squadrons, with a number of 60 pupils in each, are analogous to those of the School Companies, special attention only being given to instruction in riding and practical exercise in the Cavalry service; for which purpose each Squadron is provided with 71 horses.

The first of the School Squadrons forms a Regiment of Dragoons, the second one of Lancers, and the third one of Hussars.

The subjects taught are as follows:—

1. Religious Knowledge. 2. One of the National Languages. 3. Arithmetic. 4. Elements of Geometry. 5. Geography and History of Austria. 6. Military Correspondence, and Management of the Internal Affairs of a Squadron. 7. Knowledge of Cavalry Arms. 8. Rules and Regulations. 9. Rules of Cavalry Drill, Exercise, and Manœuvring. 10. Knowledge of Horses and Grooming, of Bridling, Saddling, and Shoeing. 11. Calligraphy. 12. Military Drawing. 13. Riding. 14. Gymnastics, Fencing, and Swimming.

On leaving, the pupils enter the Cavalry in the grades corresponding to those mentioned above for the Infantry.

in the two Frontier School Companies, containing each 120 pupils;

The Frontier School Companies, each of 120 pupils, give three yearly courses.

In all essential points, these institutions are organized on the same plan with the Infantry School Companies. As, however, Officers and Non-commissioned Officers on the Military Frontiers are also intrusted with the general administration, and accordingly require of necessity a knowledge of political administration, of jurisprudence, and agriculture, the range of the plan of study in the Frontier School Companies is more extensive.

The following subjects are taught:—

1. Religious Knowledge. 2. The Wallachian or Illyrian Language. 3. Austrian Geography and History. 4. Arithmetic and Algebra. 5. Geometry, Plane Trigonometry, Practical Mensuration. 6. Military Correspondence and Management of the Internal Affairs of a Company. 7. Arms and Munitions. 8. Pioneer Service, Road and Bridge Making. 9. Elements of Civil Architecture. 10. Agriculture. 11. Frontier Law and Administration. 12. Rules and Regulations. 13. Rules of Drill, Exercise, and Manœuvring. 14. Calligraphy. 15. Military Drawing. 16. Gymnastics. Fencing, Swimming.

The pupils of the Frontier School Companies, at the close of their third year enter the Frontier Troops, under the conditions already stated in the case of the Infantry School Companies.

in the five Artillery School Companies, containing each 120 pupils;

The Artillery School Companies have a course of three years, and consist each of 120 scholars (pupils and attendant pupils).

The subjects of study are—

1. Religious Knowledge. 2. The Bohemian language.† 3. Austrian Geography and History. 4. Arithmetic and Algebra. 5. Geometry, Plane Trigonometry, and Practical Mensuration. 6. Popular Mechanics, First Elements of Natural Philosophy and Chemistry. 7. Military Correspondence and Management of the Internal Affairs of a Battery or Company; Computation of Estimates. 8. Artillery. 9. Field Fortification. 10. Elements of Permanent Fortification; Attack and Defence of Fortresses. 11. Rules and Regulations. 12. Rules of Drill and Exercise. 13. Calligraphy. 14. Military Drawing. 15. Elements of Descriptive Geometry. 16. Grooming, Stable Duty, Harnessing. 17. Gymnastics, Fencing, Swimming.

the best scholars here enter the Artillery Academy free of cost;

After the close of the complete course, pupils who have done remarkably well enter the Artillery as Corporals, those who do well as Bombardiers, the others as Upper Cannoneers.

The most distinguished scholars, however, pass at the close of their second year into the Artillery Academy free of cost, as Attendant Pupils (*frequentanten*), with the rank of Lance-Corporals, to receive there the education which will fit them for the rank of Officers.

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* Cadets in a regiment, *i.e.* candidates for a commission, like those appointed on the nomination of the Colonels.

† Because of the large number of Bohemians in the Artillery.

in the Engineers School Company, of 120 pupils;

The Engineers School Company contains 120 scholars, distributed in three yearly courses. The subjects taught are—

1. Religious Knowledge. 2. Austrian History and Geography. 3. Arithmetic and Algebra. 4. Geometry, Plane Trigonometry; Practical Mensuration. 5. Military Correspondence and Management of the Internal Affairs of a Company. 6. Pioneer Service. 7. Sapping and Mining. 8. Elements of Permanent Fortification. 9. Civil Architecture. 10. Arms and Munitions. 11. Rules and Regulations. 12. Rules of Drill, Exercise, and Manœuvring. 13. Calligraphy. 14. Military Drawing. 15. Architectural Drawing. 16. Gymnastics, Fencing, Swimming.

the best scholars here enter the Engineers Academy;

The scholars enter the Corps of Engineers in the same way as has been described in the case of the other School Companies; the most distinguished passing as Attendant Pupils with the rank of Lance-Corporals, free of cost, into the Academy of Engineers.

in the Pioneer School Company, of 120 pupils;

The Pioneer School Company also contain 120 scholars, similarly divided into three yearly courses.

The instruction given is similar to that of the Engineer School Company, special attention being paid to pioneering duties.

1. Religious Knowledge. 2. The Bohemian Language. 3. Austrian History and Geography. 4. Arithmetic and Algebra. 5. Geometry, Plane Trigonometry, and Practical Mensuration. 6. Popular Mechanics. 7. Military Correspondence and Management of the Internal Affairs of a Company. 8. Land Pioneering. 9. Water Pioneering.* 10. Arms and Munitions. 11. Rules and Regulations. 12. Rules of Drill, Exercise, and Manœuvring. 13. Calligraphy. 14. Elements of Descriptive Geometry. 15. Gymnastics, Fencing, Swimming.

the best scholars here enter the Engineers Academy;

After the close of the third year, the scholars enter the Corps of Pioneers, under the various conditions already described. Scholars who specially distinguish themselves will at the close of the second year be received, free of cost, as Attendant Pupils (*frequentanten*) in the Academy of Engineers; and after completing the four years' course there, be distributed as Officers in the Corps of Pioneers.

in the Flotilla School Company, of 60 pupils;

The number of scholars in the Flotilla School Company is 60; and the course of instruction three years in length. The subjects are—

1. Religious Knowledge. 2. Italian. 3. Austrian History and Geography. 4. Arithmetic and Algebra. 5. Geometry, Plane Trigonometry, Practical Mensuration. 6. Popular Mechanics. 7. Military Correspondence, and Management of the Internal Affairs of a Company. 8, 9, 10. Flotilla Navigation, Artillery, and Pioneering. 11. Rules and Regulations. 12. Rules of Drill, Exercise, and Manœuvring. 13. Calligraphy. 14. Military Drawing. 15. Elements of Descriptive Geometry. 16. Gymnastics, Fencing, Swimming, and Boating.

the best scholars here enter the Artillery Academy;

The most distinguished scholars are sent, free of charge, at the end of the second year, to the Artillery Academy, and after completing the four years there, enter the Flotilla Corps as Officers. The others leave at the end of three years under conditions similar to those already described.

and in the Marine School Company, of 150 pupils;

The Marine School Company contains 150 pupils, and its course of instruction lasts four years.

The subjects are—

1. Religious Knowledge. 2. German. 3. Italian. 4. Illyrian. 5. Natural History. 6. Geography and History. 7. Arithmetic. 8. Algebra. 9. Geometry and Plane Trigonometry. 10. Popular Mechanics. 11. Military Correspondence and Management of the Affairs of a Company. 12. Artillery, Arms, and Munitions. 13. Rules and Regulations, by Land and Sea. 14. Rules of Drill, Exercise, and Manœuvring. 15. Calligraphy. 16. Common Drawing and Machine Drawing. 17. Military Drawing. 18. Gymnastics, Fencing, Swimming.

The pupils will also be thoroughly exercised in boat manœuvring, in the use of sails, and of cannons, and after the end of each year's examination, will pass some weeks on board a sailing vessel for practice.

Pupils who either through want of capacity or of diligence fall behind in the theoretical instruction, will at the end of the second year be sent on board ship as ship's boys (*Schiffs-junge.*)

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* Pontooning being included in the duties of the Pioneers.

The other scholars go through the courses of the third and fourth year, and then pass, on the same plan as in the Infantry School Companies, into the Marine Infantry, or as Marine Artillerymen or as Engineering pupils * of the first class, into the Navy, or into the Arsenals Works Company, to devote themselves to Naval Architecture.

the best scholars enter the Artillery Academy.

The best scholars enter after four years instruction as Attendant Pupils in the Artillery Academy, and after completing their time there are admitted as Second Lieutenants of the second class into the Marine Artillery.

II. Schools for Officers.

1. *The Cadet Institutions.*

The general object is to prepare pupils for the Academies.

The object of these is to prepare pupils for the instruction in military science given in the Academies.

They are four in number, with 200 pupils in each.

They contain military or treasury places, either wholly or half gratuitous; places on provincial and private foundations; and finally places for paying pupils.

There are four, each with 200 pupils.

The exact number of places open to pupils on provincial and private foundations, and to paying pupils, cannot be determined, as in this respect the Cadet Schools form a single whole with the Academies, and the amount can only be fixed as a total for these institutions taken together. There are altogether 1,100 of these military places, which may be distributed in varying proportions amongst the Cadet Schools and the Academies; the number in any one of them cannot be stated as a rule.

The Cadet Schools and the Academies contain altogether an aggregate of 1,100 military places, either free or half-free.

The military foundations are reserved for the sons of Officers serving or having served with the sword; the entirely gratuitous places for the sons of Officers in want, and the half gratuitous places for those of Officers provided with means of their own, or serving in higher positions.

Officers employed in the Outfit Department, Remounting † Department, the Department of Military Law and Jurisdiction ‡ are thus excluded, unless they have previously served with the sword. But for the sons of these Officers, of the Military Judges, the Military Surgeons, and other Officials, having attained the eleventh or any higher allowance class,§ there will be reserved eight entirely and eight half gratuitous places in the Cadet Schools and the Academies.

Appointments to the military and provincial foundations are granted by His Majesty, the former on the recommendation of the Supreme War Department, the latter on that of the Minister of the Interior. Among the former are included, as already stated, the most distinguished pupils of the Lower Houses of Education, for whose transfer to the Cadet Schools the rules are laid down, the recommendation being annually submitted for His Majesty's approval.

Special regard will be given to candidates whose fathers have been killed or invalided in the field; after these, to those who are orphans on both sides; to the sons of Officers of special merit, of Officers with large families, and the like.

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* The Marine Infantry do not serve like our Marines on board ship, but only on the coast. The Marine Artillery and the Engineering pupils (*Maschinen-lehrlinge*) serve on board.

† For the Outfit Department (*Monturs Commission*), see a previous Note. The business of the Remounting Department or Remounting Establishments (*Remontirungs Anstalten*) is to supply the cavalry with horses. There are several of these great establishments for buying and breeding horses; the largest of all in Gallicia.

‡ *Auditoriat.*—There is an *Auditor* or Military Judge in each regiment. He has passed through his course as a law student, and declared for this branch. In every province there is a central department. These law officials rise through all the grades from Lieutenant up to General.

§ One of the marks of superior rank is the amount granted for *allowances*, for which there is a carefully graduated scale.

Appointments upon provincial and private foundations, or as paying pupils, will be made in the manner already stated in the general account of the Educational Institutions.

The age of admission is the eleventh year completed, and twelfth year not exceeded, and the candidate will be expected to know the subject of instruction prescribed for the third class of the common (*normal*) schools. *Admission at 11 years old.*

A knowledge of German, however, will not be considered indispensable. Pupils who are not Germans will receive in the first half year of the first course special instruction in German.

The instruction continues during four yearly courses. The command is held by a Field Officer, assisted by— *Officers and teachers.*

1 Subaltern Officer as Adjutant.
2 Captains.
10 Subaltern Officers.
2 Ecclesiastical Professors.
1 Accountant.
1 Army Surgeon.
1 Surgeon's Assistant.
12 Sergeants for Inspection.
4 Orderlies, together with the requisite number of mechanics and servants.

The subjects of instruction are,— *Subjects of instruction.*

1. Religious Knowledge. 2. German Language and Art of Speaking. 3. French. 4. Natural History. 5. Geography. 6. History. 7. Arithmetic. 8. Algebra. 9. Geometry and Plane Trigonometry. 10. Rules of Drill and Exercise. 11. Calligraphy. 12. Common Drawing. 13. Gymnastics, Single-stick, Swimming.

Those pupils who satisfactorily complete their four years' course are transferred, according to their capacities, and as far as possible, to their own wishes, into one of the Military Academics. Entrance into the Marine Academy takes place at the close of the second year. *Pupils after four years enter one of the Academies.*

Pupils who do ill, will, at the close of any one of the three first years, be removed into the course of the following year at one of the Upper Houses of Education; or, at the close of the fourth year, into one of the Infantry School Companies. *Those who do ill are sent to the schools for Non-commissioned Officers.*

This removal, in the case of paying pupils, will be dependent on the consent of the parents; failing which, they will be sent back home.

2. *The Military Academies.*

The object in these is to educate Officers in the higher military subjects for the different arms of the service.

There are four Academies; the Neustadt Academy, the Artillery Academy, the Engineers Academy, and the Marine Academy. *These are four in number; for the Line, for the Artillery, for the Engineers, and for the Marine.*

The scholars in each are divided into four yearly courses of nearly equal numbers. In the Neustadt Academy each year is subdivided into two parallel classes, the instruction being the same in both.

The pupils in the Military Academies are of the different kinds described in the account of the Cadet Houses, and the appointments similarly made; the Academies and the Cadet Houses in these respects forming a single body.

Candidates for admission into the Neustadt Academy, the Artillery Academy, or the Engineers' Academy, must be nearly, if not quite, fifteen, and not above sixteen years old. For admission into the Marine Academy, they must be nearly, if not quite, thirteen, and not above fourteen years old. *Admission at 15 or 16 years old.*

The Academies receive their pupils in the first instance from the Cadet Schools, after the satisfactory completion of the fourth (or, in the case of the Marine Academy, the second) year, and then, as already stated under the head of the School Companies, from the Artillery School Companies, and from the Engineers', Pioneers', Flotilla, and Marine School Companies, after the highly satisfactory completion of the second (or, in the Marine School, of the fourth) year. *The pupils come from the Cadet Houses, from places of civil education, and in the Artillery and Engineers Academies also from the School Companies.*

Pupils from these School Companies, before entering the Academies, will

take the Military Oath, receive the rank of Lance-Corporals, and be admitted free of charge as Attendant Pupils into the Academies, to receive their education for the rank of Officer. Scholars from the general body of soldiers, who are attending the School Companies, are to be treated, in respect of their transfer to the Academies, in the same way as the other pupils.*

Entrance Examination.

Entrance into the Academies is confined to the commencement of the first year.† Pupils admitted from places of private instruction are examined in the subjects taught in the Cadet Schools; those who wish to enter the Neustadt, the Artillery, or the Engineers Academy, in the following subjects, to the extent here described:

1. German:—The Art of Speaking; Prosody; the Rules of Speaking; the various Rhetorical Styles.
2. Natural History:—General knowledge of the Three Kingdoms.
3. French:—General grammatical rules; Translation from German into French.
4. Geography.
5. History:—Ancient and of the Middle Ages.
6. Geometry and Rectilinear Trigonometry, with the Application of Algebra, and the Solution of Geometrical Problems.
7. Common Drawing.

Candidates for the Marine Academy will be required to know,—

1. The German Grammar, including Syntax.
2. Zoology.
3. French:—The Auxiliary Verbs, the Four Conjugations; Reading.
4. General Geography.
5. Ancient History.
6. Arithmetic and Algebra as far (inclusively) as Equations of the First Degree, with two unknown Quantities.
7. Common Drawing.

Candidates from both institutions must also possess the degree of religious knowledge corresponding to their age, and must write a good current hand.

Removal of negligent pupils into the School Companies.

Pupils who are found negligent in the course of their academical studies, will at the close of the first, second, or third year be transferred to the classes corresponding to their age in the School Companies, or will be enlisted in the Army as Cadets if they possess the requisite bodily qualifications, in the manner already described.‡

The Neustadt Academy.

It consists of 400 pupils, chiefly for the Line and Frontier Infantry; secondly for the Chasseurs and Cavalry.

Wiener Neustadt having been the seat of this Academy for more than a century, the ancient name thence derived will be retained in its usual acceptation, though the Academies for the Artillery and the Engineers will also be placed in the same locality. The institution counts 400 pupils, designed primarily for the Infantry of the Line and of the Frontier, and secondly, for the Chasseurs and the Cavalry.

The establishment for teaching and management consists of 38 Officers, and amounts with servants, soldiers on duty, &c. to 309 persons.

The Director of the Academy is a Colonel or General, attached to whom, for purposes of instruction, discipline, and general management, there are three field and thirty-four other Officers; for religious care and instruction, four Ecclesiastics; for medical attention, one Regimental Surgeon, one Army Surgeon, and one surgeon's assistant; for the accounts, one Accountant, and four Accountant's Assistants. The large number of pupils maintained in the institution requires, moreover, a proportionately large staff for superintendence, a numerous body of attendants, servants, and the like; so that the whole number to be added to that of the pupils does not fall short of 309 persons; 64 horses are allowed for the riding lessons.

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* In the School Companies it will be remembered there are two different sets of Scholars, those who have come from the Houses of Education or from private schools, and those who *attend* after two years' service in the Army. These are *frequentanten* in the School Companies, but all alike, who come from the School Companies, are *frequentanten* in the Academies.

† It appears, however, that a transfer of pupils, for example, from the Engineers Academy to Wiener Neustadt, in consequence of incapacity for Mathematics, is allowed at a later standing. After passing a year at Znaim, a young man may enter the second year's course at Neustadt.

‡ The wishes of the parents are, of course, consulted in the case of paying pupils, but it is said that their consent is very generally given.

Subjects of instruction.

The plan of study is based on that of the Cadet Schools, and embraces the following subjects:—

1. Religious Knowledge. 2. French. 3. Italian. 4. Bohemian. 5. Hungarian. 6. Logic and Psychology. 7. Geography. 8. History. 9. Analytical Geometry and Higher Analytical Mathematics. 10. Mechanics, Spherical Trigonometry, Mathematical Geography, Triangulation. 11. Natural Philosophy, Elements of Chemistry. 12. Practical Mensuration, taking Maps at Sight. 13. Descriptive Geometry. 14. Military Composition. 15. Positive International Law,* Austrian Civil Law (*Privat Recht*). 16. Military Penal Law and Procedure. 17. Pioneer Service, with Field Fortification. 18. Permanent Fortification. 19. Civil Architecture. 20. Arms and Munitions. 21. Study of Ground and Positions, and Military Drawing. 22. Rules and Regulations, and Military Administration. 23. Rules of Infantry Drill and Exercise. 24. Rules of Cavalry Drill and Exercise. 25. Manœuvring. 26. Riding. 27. Gymnastics. 28. Fencing. 29. Dancing. 30. Swimming.

Pupils who show a talent for general drawing will be practised in it.

Promotion on leaving.

After the completion of the fourth year's course the pupils will be recommended by the Supreme War Department to His Majesty for nomination as Second Lieutenants of the second class.

In their distribution into the various regiments, &c. of the army, the choice of the pupils will, as far as possible, be considered.

The pupils upon leaving will be, without exception, fully equipped at the expense of the State. Only in the case of the pupils who wish to enter the Cavalry, the parents (or guardians) will be called upon to give security for the payment of 1,000 florins (100*l.*) towards the expenses of the first equipment, and for a monthly allowance of 25 florins (2*l.* 10*s.*).

3. *The Artillery and Engineers Academy.*

Similar in their arrangements.

The arrangements of these two Academies are in many respects similar, as required by the character of the two kindred sciences for which they are founded.

They contain 200 pupils each.

The number of scholars is fixed at 160 pupils, and 40 attendant pupils (*Frequentanten*) in each.

The command in each is intrusted to a General or a Colonel.

For the smaller number of scholars, fewer instructors, superintendents, and attendants are needed; the complete amount in each Academy is fixed at 200 men, in addition to the scholars. Each has thirty-two horses allowed to it.

Subjects of instruction common to both.

The plan of instruction is in many respects identical in each.

The subjects taught in both are—

1. Religious Knowledge. 2. French. 3. Italian.† 4. Logic and Psychology. 5. Geography. 6. History. 7. Analytical Geometry and Higher Analytical Mathematics. 8. Descriptive Geometry. 9. Mechanics and the Elements of the Study of Machinery. 10. Mathematical Geography. 11. Natural Philosophy and Chemistry. 12. Practical Mensuration, taking Plans at Sight. 13. Military Composition. 14. International Law; Austrian Civil Law. 15. Military Penal Law and Penal Procedure. 16. Military Drawing; Study of Ground and Positions. 17. Rules and Regulations, and Military Administration. 18. Riding. 19. Gymnastics. 20. Fencing. 21. Dancing. 22. Swimming.

Common drawing will be treated, as it is at the Neustadt Academy, as an optional subject.

Additional studies in the Artillery Academy.

In the Artillery Academy the following additional subjects will be taught:—

1. Bohemian.‡ 2. Field Fortification and Permanent Fortification. 3. Tactics of the Three Arms. 4. Artillery. 5. Sieges, Construction of Batteries; Artillery. 6. Rockets. 7. Rules of Drill and Exercise in the Artillery and Infantry. 8. Instruction in shoeing horses, in judging of their Age, in judging of them at Sight, in Bridling, Saddling, and Grooming.

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* The Law of Nations as it exists *de facto*, without consideration of its principles.

† This is at present, in point of fact, omitted for want of time.

‡ The Artillery is recruited very largely from Bohemia and Moravia. A knowledge of the Bohemian language (which is pretty nearly the same as Moravian) is therefore essential for an Officer in the command of Artillerymen.

Also in the Engineers Academy.

In the Academy of the Engineers the additional subjects are:—

1. Arms and Munitions and Artillery. 2. Art of Fortification. 3, 4. Civil Architecture, Plain and Ornamental. 5. Pioneer Service. 6. Rules of Drill, Exercise, and Manœuvring.

Promotion on leaving.

The pupils of the two Academies enter in the same way as those at Neustadt, after the satisfactory completion of four years' instruction, with the rank of Second Lieutenant of the Second Class, the respective services of the Artillery, and of the Engineers or Pioneers. Pupils for whom no vacancies can be found enter the Infantry.

Some enter the Infantry.

4. *The Marine Academy.*

Numbers 100.

This, like the other Academies, is in the charge of a Field Officer, or a General.

The pupils are 100 in number; the Teachers, other Officers, and attendants, 88.

Age, earlier.

One essential distinction here (explained by the necessity of habituating the pupils to the sea) is the admission at an age earlier by two years, and the proportionally earlier termination of the course.

Subjects of instruction.

The plan of instruction combines a continuation of the studies prescribed in the Cadet Schools, with the commencement of those specially required for the marine service, viz.:—

1. Religious Knowledge. 2. German. 3. Italian. 4. French. 5. English. 6. Geography. 7. History. 8. Algebra. 9. Geometry and Plane Trigonometry. 10. Analytical Geometry and Higher Analytical Mathematics. 11. Spherical Trigonometry and Nautical Astronomy. 12. Mechanics and Natural Philosophy. 13. Descriptive Geometry. 14. Navigation. 15. Military Composition. 16. International Law, Austrian Civil Law, Sea Law. 17. Military Penal Law, and Penal Procedure. 18. Artillery. 19. Fortification, Attack and Defence of Coast Fortifications. 20. Naval Tactics and Naval History. 21. Knowledge of Rigging, &c. (*Takelungslehre.*) 22. Naval Manœuvres. 23. Naval Architecture. 24. Signals. 25. Rules and Regulations. 26. Rules of Drill and Exercise. 27. Calligraphy. 28. Military Drawing. 29. Common Drawing. 30. Swimming. 31. Gymnastics. 32. Fencing. 33. Dancing.

In addition to the practical instruction given in the course of the school year, the pupils of the three first years will in the months of August and September be sent in sailing vessels on a voyage for practice.

Promotion.

The pupils at the end of four years enter as Cadets into the Navy, the Flotilla Corps, or the Corps of Naval Architecture.

After completing a practical course of two years, they will receive their promotion as Second Lieutenants of the second class.*

III. Special Schools.

1. *The Military Teachers School.*

Two objects, to train teachers, and to train masters in gymnastics.

The object here is a double one; first, to bring up good and serviceable teachers in the subjects of study prescribed for the Military Houses of Education; secondly to provide at the same time instructors in gymnastics and fencing for all the military schools and for the troops. The institution accordingly consists of two departments, each of thirty Attendant Pupils, receiving instruction in these two different branches.

Two departments. Numbers, 30 *in each.*

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* Literally, "as *Frigate-Ensign*, or Second Lieutenant of the second class," the former being in rank the same as the latter. The order of rank is,—

Captain	of a Man-of-War	equal to a	Colonel in the Army.
„	of a Frigate	„	Lieutenant Colonel ditto.
„	of a Corvette	„	Major ditto.
Lieutenant	of a Man-of-War	„	First Captain ditto.
„	of a Frigate	„	Second Captain ditto.
Ensign	in a Man-of-War	„	First Lieutenant ditto.
„	in a Frigate	„	Second Lieutenant ditto.

In the Corps of Naval Architecture the ordinary military titles are used.

Non-commissioned Officers are admitted after a service of at least two years. Candidates for admission into the Teachers' department must, in addition, possess the required amount of knowledge in the subjects taught in the Military Houses of Education; and, as a rule, must know, besides German, one other of the Austrian national languages. Proficiency in every one of the subjects will not be considered essential. Candidates for admission to the Gymnastic and Fencing Department will be required to show a certain amount of readiness in the use of arms and in gymnastic exercises, and an evident capacity for acquiring greater skill. *Admission.*

Registration for admission is to be obtained in the usual course of the service from the Supreme War Department.

The Attendant Pupils receive, in addition to their ordinary pay, bread and the extra allowance; and for their better subsistence also an allowance corresponding to that granted for provision during a march. *Pay.*

The command is held by a Field Officer or Captain; six Subaltern Officers and four Sergeants act as teachers, the latter as assistants in the instruction in fencing and gymnastics, and as swimming master. The instructor in the art and methods of teaching may be a civilian. *Establishment.*

The subjects of instruction in the Teachers' Department are— *Studies and Exercises in each department.*

1. The Art and Methods of Teaching. 2. German. 3. Another Austrian Language. 4. Arithmetic and Geometry. 5. Geography. 6. Military Composition, and the Management of the Internal Affairs of a Company. 7. Calligraphy. 8. Common and Military Drawing. 9. Gymnastics, Fencing, and Swimming.

In the Gymnastic Department,—

1. Staff, Rapier, Sword, and Bayonet Fencing. 2. Gymnastics and Swimming. 3. Knowledge of Fire-arms.

In both Departments a certain number of hours weekly will be devoted to Military Exercise.

Instruction in all the subjects will be given with special reference to the methods to be pursued in teaching them in the various Military Schools.

The course in each Department lasts one year. Under certain circumstances particular pupils in the Teachers' Department may remain for the further completion of their studies a second year in the institution. *The course lasts one year only.*

In the Teachers' Department, pupils who show no aptitude or liking for some particular subject, may be exempted from attending the lessons given in it, so as to allow them to give more thorough attention to other branches.

After passing the examination, the pupils are either sent immediately to undertake duty in the Military Schools, or return to their service in the troops, and pass, as occasion requires, into the Military Schools. Corporals who distinguish themselves by remarkably good progress will be promoted to the rank of Sergeant. *Promotion.*

2. *The United Higher Course for the Artillery and Engineers* *—

Has for its object the more advanced instruction of young Officers in a scientific and technical point of view, for service in the Artillery and Engineers. *To give advanced instruction to Officers.*

Twenty Officers, of more than usual capacity, between twenty-one and twenty-six years of age, will be admitted from each of the two arms. They must be unmarried, and must have served with distinction during a period of not less than two years. *Numbers in each arm,* 20. *Age,* 21 *to* 26.

Officers in whose case these conditions are satisfied, and who desire to be admitted to the course, apply for registration for admission to the examination, in the ordinary form, to the War Department.

Officers who, in the month of October, are summoned to attend, may charge their travelling expenses to the Treasury, and undergo an examination before the Professors attached to the Course, in the following subjects:— *Examination for admission.*

1. Analytical Geometry and Higher Analytical Mathematics. 2. Mechanics and the Elements of the Study of Machinery. 3. Natural Philosophy and Chemistry. 4. Military *Subjects.*

* This course has not yet been properly established. A rudimentary class of the kind exists in the Engineer Academy at Klosterbruck of Znaim (*see* the account of that Academy), but the complete plan will hardly be carried into effect before the new building is finished at Wiener Neustadt.

Composition. 5. French. 6. Military Drawing, tested by the production of a Drawing of their own doing.

Candidates for the Artillery will be, moreover, examined in the Tactics of the three Arms, and in Artillery; and those from the Engineers in the Art of Fortification and in Civil Architecture, both Plain and Ornamental.

The text books used in the Academies of the Artillery and Engineers will serve as a measure for the range of attainment required. Pupils who passed with distinction through these Academies will thus be specially fitted for admission into the Higher Course after they have proved, during their time of service, their diligence in bringing the knowledge they have acquired into actual application.

On the close of this preliminary examination, the results will be submitted to the Supreme War Department, and the recommendation for admission laid before His Majesty.

Establishment.

A superior Field Officer, either of the Artillery or the Engineers, will be entrusted with the charge of the united course. The lectures will be given by the Professors of the Academy of the Artillery and Engineers. From the nature of the duties, partly common and partly distinct, which devolve upon the two corps, it follows that the course of the studies (which will be carried on during two years) will in like manner be partly common and partly separate.

The subjects of common instruction will be—

Subjects of common instruction.

1. Mechanics in application to Machinery, combined with Machine Drawing 2. Natural Philosophy and Chemistry, combined with practice in manipulation, in making experiments, and in analysing. 3. Theory of Artillery, in reference to the constructions that occur in Artillery. 4. Higher Tactics. 5. Principles of Strategy, illustrated by the representation of campaigns, with special attention to the use of Artillery, as well in Attack and Defence of fortified places, as in the field.

Instruction for Artillery Officers.

Separate instruction will be given to Artillery Officers in—

1. Service in Workshops, Depôts, and Arsenals. 2. Knowledge of Foreign Artillery, of the requisites (*ausrüstungen*) for Field service and Sieges, and for furnishing fortified places.

Instruction for Engineer Officers.

To Engineer Officers, in—

1. Ornamental Architecture, combined with Architectural Drawing. 2. The Art of Fortification, special attention being given to working out projects.

The pupils receive in addition practical guidance and supervision in all subjects of a scientific nature connected with the Art of War.

Promotion.

The pupils of the second year undergo an examination in October. Upon the results of the examination the War Department decides on their promotion for the rank of Second to that of First Lieutenants.

3. *The War School.*

For the Staff and Upper Adjutancy.

The object of the War School is to give Officers of all arms an education for higher duties, especially for those of the Staff and of the Upper Adjutant Department.*

Open to Officers between 21 and 26.

Any Subaltern Officer of the active army, without distinction of arms, may claim admission into the War School, provided he is above twenty-one and under twenty-six years old, is unmarried, and has served as Officer uninterruptedly and with distinction two years at least with the troops, and, provided, finally, he has passed the prescribed preliminary examination.

Conditions and subjects of the entrance Examination.

For admission to the examination, registration, to be obtained in the usual form from the War Department, is requisite.

The examination is conducted between October 10th and 20th, in the War School buildings; the registered candidates will be summoned to Vienna at the beginning of October; travelling expenses will be paid by the Treasury. The subjects are,—

1. Algebra and Geometry, including Plane and Spherical Trigonometry. 2. Geography. 3. History. 4. Arms and Munitions. 5. Field and Permanent Fortification. 6. Pioneer Service. 7. Rules of Drill and Exercise (in detail, for the arm in which the candidate has served, and generally for the other arms). 8. Manœuvring. 9. Military drawing,

* The Higher *Adjutantur* or the Aide-de-Camp Department.

tested by the production of a drawing of the candidate's own doing. 10. Military Composition, tested by working out an exercise in the presence of the Commission. 11. French. And finally, 12, the candidate must be able to speak one of the national languages of the Austrian Empire, Slavonic, Hungarian, or Italian, and must write a good current and legible hand.

The amount of knowledge required in these subjects will be regulated by the range of the text books prescribed for use in the Academy at Neustadt. Regard, however, will not so much be given to the minutiæ of knowledge possessed by the candidate, but rather to the evidence of his having a correct judgment and quick apprehension, and the power of expressing himself both orally and in writing.

Upon the results of the examination, formally drawn up by the authorities of the school, recommendations for admission will be submitted to the sanction of His Majesty.

Number, 30.

The number of attendants in the War School is fixed at thirty, and the length of course is two years.

Additional allowances.

The attending pupils receive, in addition to their ordinary pay, a monthly allowance of twenty florins, rations, and allowance for two horses; when employed in taking surveys and reconnoitring, they have an extra allowance of thirty florins monthly.

The Officers and teachers.

The War School is commanded by a General or Superior Field Officer.

Five Field Officers or Captains, taken as a rule from the Staff, give lectures on the prescribed scientific subjects. One Field Officer or Captain of Cavalry takes the duty of riding-master; and one civil Professor that of instruction in the French language and literature. Necessary officers, attendants, and servants take the duty of adjutants, of the internal management, of the service, and of attending to the thirty horses.

Subjects of study.

The first year's subjects of instruction are,—

1. Military Drawing and the study of Ground and Positions. 2. Higher Tactics. 3. Staff and Superior Adjutant Duty. 4. French Language and Literature. 5. Riding.

Those of the second year,—

1. Military Drawing, Ground and Positions. 2. Military Geography. 3. Principles of Strategy, illustrated by representations of some of the most instructive campaigns. 4. French Language and Literature. 5. Riding.

The course begins on the 1st of November, and lasts to the end of September.

Practice in various Arms.

The Attendants at the War School must be practised in those arms in which they have not served. They are for this purpose distributed into the various bodies of troops forming the garrison of Vienna, go through the exercises and manœuvres of these troops—in the first year with one, and in the second with the other arm. At the termination of these periods of practice, they will be called upon to undertake the command of a Battery, of a Squadron of Cavalry, and of a Division of Infantry.

Surveying, &c.

In the month of May, the attendant pupils of the first year will go out upon a course of practical surveying; those of the second year will be similarly employed in reconnoitring, choosing sites for encampment, discovering, judging of, and describing proper points for taking up positions, forming *têtes-de-pont*, entrenched camps, and the like, and in performing other duties falling within the service of the Staff.

Examination for Promotion, both oral and on paper. By this their position henceforth in the Army and on the Staff is determined.

At the beginning of October, the pupils of the second year will undergo an examination, which will be conducted both orally and by papers.

Upon the results of this the Supreme War Department will determine upon their promotion to the rank of First Lieutenants (if they are not already of that rank), and this without any reference to their previous position, their position henceforth being simply determined by their merit.

The same grounds determine the cases of those who are admitted to the Staff, or who return to their respective arms.

Special promotion after three years service.

Those who after a satisfactory completion of the course return to service with the troops, will, after three years' meritorious service, be specially recommended for extraordinary promotion.

Control of the Institutions.

The Institutions are generally under the Supreme War Department.

The Upper and Lower Houses of Education, the Infantry School Companies, the Cavalry School Squadrons, and the Frontier School Companies, are under the orders of the Commanders of the Army, the Army Corps, or the military government in whose district they are situated. The Artillery and Engineer School Companies are under the orders of the General Artillery and Engineer Departments;* the Pioneer and Flotilla School Companies, under those of the Quartermaster-General's Department;† the Marine School Company, under those of the Admiralty.‡ Which functionaries, however, receive from the Supreme War Department all directions relating to organization and instruction.

The Cadet Schools, the Academies, the Military Teachers' School, the Upper Artillery and Engineer Course, and the War School are immediately under the orders of the Supreme War Department.

The general organization of all the military schools and places of instruction is once for all established by the regulations sanctioned by His Majesty. These regulations contain all that concerns the physical, moral, and intellectual training of the pupils, and all have the one object of rearing them up as worthy members of the Austrian army, and faithful supporters of the throne and of the honour of their country.

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* *General-Genie-Direction. General-Artillerie-Direction.* † *General-Quartier-Meister-Stab.*
‡ *Marine-Ober-Commando.*

SUPPLEMENTARY DOCUMENT.

No. 2.

List of Foundations.

No. 2.

I.—Military (*Militär-Ärarial*) Places or Foundations.

	Number of Places in the	
	Cadet Schools and Academies.	Houses of Education and School Companies.
1. For sons of Officers serving with the sword (*i.e.* on active service) :—		
Free places - - - - - -	892	—
Half places - - - - - -	192	—
2. For sons of Officers not serving with the sword, sons of Military Judges, Army Surgeons, Army Officials, from the 11th allowance class upwards :—		
Free places - - - - - -	8	—
Half places - - - - - -	8	—
3. For sons of Soldiers (free places, not including those given in the School Companies).	—	3,000
Total - - -	1,100	3,000

II.—Provincial (State or Estates) Foundations [*Landes-(Staats-und-Ständische) Stiftungen*].

	Number of Places in the	
	Cadet Schools and Academies.	Houses of Education and School Companies.
1. Lower Austria - - - -	12	6
Upper Austria - - - -	6	3
Bohemia - - - - -	24	12
Moravia - - - - -	9	4
Silesia - - - - - -	6	3
Styria - - - - - -	12	6
Carinthia - - - - -	6	3
Carniola - - - - -	6	3
Lombardy - - - - -	22	5
Venetian Lombardy - - -	20	5
Dalmatia - - - - -	3	1
The Coast - - - - -	4	1
Galicia - - - - - -	40	10
The Tyrol - - - - -	2	3
Hungary - Transylvania - The Banat - Croatia - - in course of formation.		
Total - - -	172	65

III.—Private (including Municipal) Foundations (*Privat-Stiftungen*).

	Number of Places in the	
	Cadet Schools and Academies.	Houses of Education and School Companies.
1. The foundation of the city of Brünn for sons of Austrian subjects in Moravia, and preferentially in Brünn, established by the city of Brünn in commemoration of His Majesty's escape from assassination in the year 1853.	—	1
2. The Chaos foundation for the Chaos foundationers in the Orphan House at Vienna. Appointment by the Magistracy of Vienna.	2	—
3. The foundation of Major Francis von Cöls for children of Soldiers, &c. (*The List is continued in detail.*)	—	14
Total - - -	48	125

The result is that there remain 300 places open to pupils whose parents pay for them, in the Cadet Schools and Academies, and 310 in the Houses of Education.

It may be interesting to observe that amongst these foundations are two Irish, the O'Brady and the O'Gara. The first is for young Irishmen of birth and family; the right of presentation rests with the Roman Catholic Archbishop of Dublin. The second is for the sons of Officers in the Austrian Service of Irish family, or, in absence of them, for young Irishmen of noble birth; the right of presentation rests with the Director-General of the Engineers for the time being.

APPENDIX II.

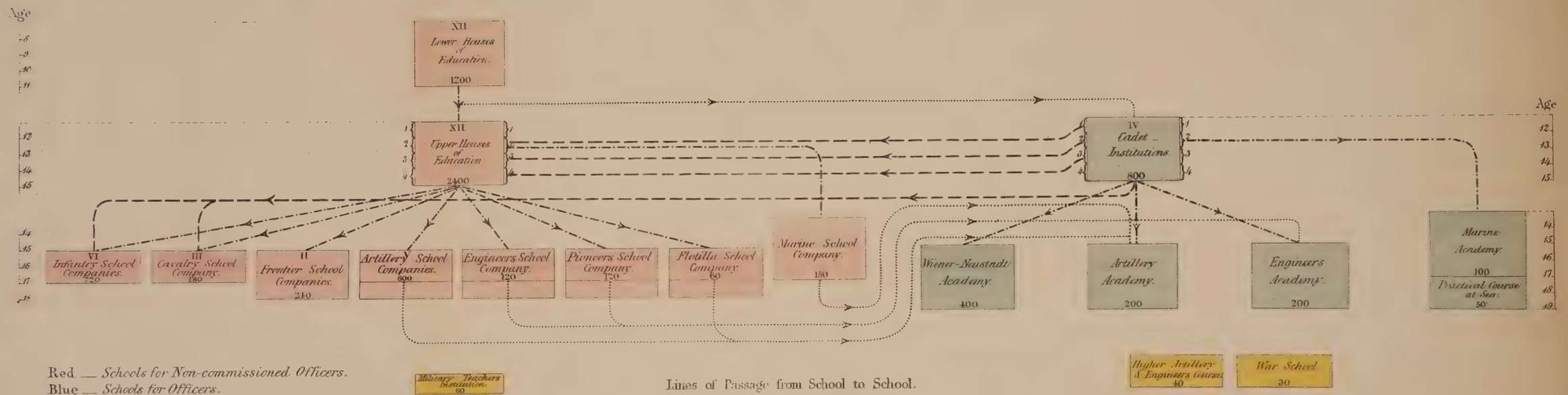
GENERAL VIEW

OF THE

IMPERIAL INSTITUTIONS FOR MILITARY EDUCATION,

AND OF

THEIR CONNECTION WITH EACH OTHER.


Age
XII Lower Houses of Education. 1200
XII Upper Houses of Education 2400
IV Cadet-Institutions. 800
VI Infantry School Companies. 220
III Cavalry School Company. 180
II Frontier School Companies. 240
Artillery School Companies. 600
Engineers School Company. 120
Pioneers School Company. 120
Flotilla School Company. 60
Marine School Company. 150
Wiener-Neustadt Academy. 400
Artillery Academy. 200
Engineers Academy. 200
Marine Academy. 100
Practical Course at Sea. 50
Military Teachers Institution. 60
Higher Artillery & Engineers Course. 40
War School. 30
Red — Schools for Non-commissioned Officers.
Blue — Schools for Officers.
Yellow — Senior and Special Schools.
Lines of Passage from School to School.
the best } pupils.
incapable }
ordinary passage.

Military Houses of Education.

Lower.

JOSEFSTADT.
PRERAU.
KREMS.
HALL.
BELLUNO.
FIUME.
PANCSOVA.
SZAMOS-UJVAR.
GROSSWARDEIN.
WAITZEN.
LEMBERG.
PRZEMYSL—(TARNOW, 1855).

Upper.

KUTTENBERG.
BRÜNN—*Prosnitz*—(WEISSKIRCHEN, Moravia, 1856).
ST. PÖLTEN—*Linz—Enns*—(ST. PÖLTEN, 1855).
MARBURG—*Weitz*—(STRASS, 1856).
SERRAVALLE.
PETRINIA.
KARANSEBES—*Bosovich*—(KAMIENITZ, 1856).
ORLAT—(HERMANNSTADT, 1856).
KASCHAU—*Bartfeld*—(KASCHAU, 1856).
PRESSBURG—(GÜNNS, 1856).
LEMBERG.
TESCHEN—(CRACOW, 1865).

School Companies.

I. Infantry School Companies.

OLMÜTZ.
BRUCK on the Leitha.
KLOSTERNEUBURG.
HAINBURG.
FISCHAU.
GRATZ.

II. Cavalry School Squadron.

WEISSKIRCHEN, Moravia (1857).

III. Frontier School Companies.

WEISSKIRCHEN.
BELOVAR.

IV. Artillery School Companies.

PRAGUE.
VIENNA.
PESTH.
GRATZ.
VERONA.

V. Engineers School Company.

KREMS.

VI. Pioneers School Company.

TULN.

VII. Flotilla School Company.

KLOSTERNEUBURG.

VIII. Marine School Company.

TRIESTE.

Cadet Institutions.

HAINBURG.
STRASS—(EISENSTADT, 1856).
CRACOW—(ZNAIM, 1865).
MARBURG.

Academies.

Neustadt.
WIENER NEUSTADT.

Artillery.
OLMÜTZ—(WIENER NEUSTADT, 1856).

Engineers.
ZNAIM—(WIENER NEUSTADT, 1865

Marine.
TRIESTE.

Military Teachers' Institution.
WIENER NEUSTADT.

Higher Artillery and Engineers Course.
(WIENER NEUSTADT, 1865.)

War School.
VIENNA.

NOTE. *The Names inclosed in brackets show the places to which the Institutions will be transferred, and the Year in which they will be so.*
The Names printed in Italics show the Subsidiary Institutions which cease to exist after the transfer.

GENERAL REMARKS ON AUSTRIAN MILITARY EDUCATION.

Chief points of remark.

The points most deserving of attention in the Austrian Education are,—the teaching and encouragement given to Non-commissioned Officers; the State, Provincial and Private foundations for military education; the general care and height of all the teaching; the particular merits of the Staff School; and the constitution of the Department of Military Education.

Teaching and promotion from the Non-commissioned Officers' School.

1. Upwards of 5,700 pupils receive an education, more than half the number free, to fit them to become Non-commissioned Officers. This education is given between the ages of seven and eighteen; it is generally conducted in three successive Schools, and the most talented and deserving pupils in the highest Schools are drafted into the Academies, whence they may obtain commissions as Officers. It may be calculated that at least 50 or 60 young men of humble birth obtain commissions yearly in this manner, in various parts of the Austrian Service. The education given is of a very solid character, chiefly in military subjects, but well calculated to cultivate intelligence and judgment.

Foundations for Military Pupils.

2. A full account has been given elsewhere of the great foundations devoted to the support of pupils at the Military Educational Institutions. It is difficult to ascertain the exact sum thus spent, but it cannot be less than 100,000*l.* yearly. The assistance is given entirely on the ground of the father's service in a military or official capacity, and not (as far as we are aware) in any case as the reward of success in an open competitive examination.

Early age at which Military Education begins,

3. Military education is, both in the case of Non-commissioned Officers and of Officers, begun at a very early age. A remarkable account is given in the official document of the manner in which a youth is pledged by his father or near relations to the service of the Emperor. Mathematics occupy a prominent place in all the stages of this education. Of the teaching of classical languages there is little or none; it was distinctly stated that the Empire supplies so many living languages of its own, that there is no time for learning a dead one.

and its character.

Careful manner of conducting it.

4. In the schools for Officers, previous to entering the Army, the studies appear to be pursued with great care. Thus, in the Artillery and Engineer Academies the subjects are high, the amount of time devoted very great, and the *credits* expressive of the pupil's success in his examinations very satisfactory. An unusually large number of pupils obtain high marks. The same character applies to Wiener Neustadt, the School for the Infantry and Cavalry, and the main feeder to the Staff School. We were struck by the apparent goodness of the discipline, the manly and gentlemanly demeanour of the pupils, and the kindness with which they seemed to be treated. It ought to be added, that the pupils of Wiener Neustadt only furnish about one-twentieth of the Officers of the whole Army. The rest enter with scarcely any examination.

Open and thorough competition of Staff School.

5. The above remarks as to careful teaching seemed to us to apply strongly to the Staff School, the chief test of merit and the avenue to distinction opened to Officers in time of peace, after three years of previous service. The studies here are few in number, but well chosen; and what is done seemed to be done thoroughly. There is open competition for entrance, and considerable advantages of pay are given to the successful candidates whilst studying at this School; and on leaving the students are placed in the order of merit, and each enters the Staff accordingly. We have explained in our account that this *merit* is not estimated solely by the standard of attainment, but that once determined, the student's reward is (as we were assured) invariably in accordance with it. But in addition to the above, very direct encouragement is offered for success in the Staff School by immediate promotion being given to the Second Lieutenant, and the prospective promotion of Lieutenants to the rank of Captain after three years more service is also ensured.

Artillery and Engineers.

6. The education of Officers for the Artillery and Engineers before entering the service is given separately in Austria. An institution somewhat on the principle of the Staff School, intended to give higher instruction to such Officers of some services as desire it, is in course of formation for these two

Corps. It is already in operation for the Engineers at Znaim. In this course a considerable portion of the instruction is intended to be common to the two services.

Special Department for Military Education.

7. The direction of all the institutions for military education is in the hands of a separate department, constituting one of the four co-ordinate sections of the War Department, of which the Emperor is the head. "The Fourth Section," as it is entitled, is even more independent than the similar department in Prussia. All its recommendations seem to be made directly to the Emperor. It is an entirely new creation, dating from the wars of 1848, 1849. It has remodelled most of the Schools, and is intrusted with their sole arrangement, and with an annual expenditure of between £300,000 and £400,000.

List of works and documents consulted.

The Rules and Regulations of the various Military Institutions in Austria are drawn up in great detail, and with the utmost precision, in lithograph. Copies of these were liberally furnished to us. But the more important portions are all contained in the Official Abridgment, of which a translation has been given.

An historical account of the Academy of Wiener Neustadt has been written by Major Leitner, Geschichte der Neustädter Militair-Academie.

The Schematismus, or Military Calendar, supplies general information as to the organization of the Austrian Army.

Articles in the Appendix.

The following documents, connected with Austrian Military Education, will be found in the Appendix:—

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Translations of Extracts from the Regulations for the Military Academies (Appendix X.)	195
Translations of the earlier parts of the Regulations for the Imperial War School (Appendix Y.)	204
List of the Text Books authorized for use in the Military Schools in Austria (Appendix Z.)	211

SARDINIA.

SARDINIA.

Sardinian Military Education of recent growth.

It is unnecessary to enter into any minute details as an introduction to the account of Sardinian Military Education, and of the Schools in which it is carried on. The wars in which Sardinia has been recently engaged, the consequent demand for Officers, and the new regulations established in many of the Schools since 1850, have combined to prevent them from being in their regular or most effective condition during the last few years. Thus the School of Ivrea, which may, perhaps, be called the peculiar contribution of Sardinia to the cause of Military Education, and which on this account we should have been anxious to visit, was closed at the beginning of this year; and the rules requiring all Lieutenants to pass through it previous to obtaining a Captaincy were relaxed during the War. The Staff School also could not be termed finally organised.

General School for all Arms, the Accademia Militare of Turin.

1. The character of the education may be described generally as partly resembling that of Austria, partly that of France. It commences very early. Every Officer who enters the Army as such must have passed through the Great Military School, the Accademia Militare. The minimum age of entrance is fourteen. The admission is by nomination and not by competition; and the demand has always been under rather than above the requirements of the Army. "Bourses" or Exhibitions to assist pupils in their education, have been established on the Prussian and Austrian, rather than on the French principle. They are granted by the King on the recommendation of the Minister, in consideration of the claims of deceased Officers, or other public servants, and without reference to the merits of the pupils, preference being given to the candidates whose circumstances most require assistance. From twenty-five to thirty of these *Bourses* (or rather *Demibourses*, for no pupils receive entire support such as is given in France,) are given annually. We are informed that a decree will appear almost immediately, throwing open *ten* out of this number to public competition. The entire sum expended upon them is 70,000 francs, about 2,800*l.* per annum.

Passing from this outline of the principles of Sardinian Military Education, as exhibited in the Accademia Militare, which may be termed the General Seminary of the Sardinian Army, we shall briefly allude to the *three* remaining Institutions, in which Officers receive instruction and training at later periods of their career.

2. Admission into the Artillery and Engineer School may be considered the reward of the most distinguished pupils of the Accademia Militare, who after spending their last year in that Institution in the study of the higher mathematics, chemistry, and architectural drawing, are transferred for the completion of their education to the School of the Artillery and Engineers.

3. The Staff School, the formation of which dates from 1850, is chiefly frequented by Officers of the Infantry and Cavalry, who must be below the age of twenty-eight years upon their entrance. It is carried on upon the competitive system, the Officers being ranged according to merit in their Final Examination, the ablest entering the Staff Corps in that order.

4. Two Institutions peculiar to the Sardinian Service are the *Schools for Officers*, one or other of which it is necessary that every Officer under ordinary circumstances should attend for a year before being promoted to the rank of Captain. One of these is for the Infantry, at Ivrea; the other for the Cavalry, at Pinerol. In saying that *every* Officer must attend these Schools, we except that proportion of *one-third* who are promoted annually from the ranks, and whose attendance apparently has not hitherto been required. But a class for Non-commissioned Officers is now being formed at Ivrea, which for the sake of economy is to be common to those of the Infantry and Cavalry. We have collected as much information with regard to the character of these Schools as

was possible since visiting Turin; at that time, owing to the pressure of war, they were not in operation.

Military education in Sardinia is entirely in the hands of the Minister of War. The annual cost for its support does not exceed 18,000*l*. The rules of promotion have recently undergone two successive alterations, one in 1855, and the other in 1856. They will be found in detail at page 252.

At the present time a certain proportion of appointments to grades below that of Major is given according to seniority, the remainder by selection. Above that rank all promotions are by selection. Reports of the conduct of Subaltern Officers are monthly sent in to a Board of six Field Officers, who are charged with the duty of making recommendations for promotion from among the more distinguished. Great stress appears to be laid on this Report or "List of Proposition." The table of qualifications which it takes into consideration has been recently sent us by the kindness of the Honourable E. M. Erskine, Secretary of Legation at Turin, whose constant assistance during our inquiry we must warmly acknowledge, and we have appended it to our account at page 255.

I.—ROYAL MILITARY ACADEMY.

(*Regia Militare Accademia.*)

Military Academy.

We have already stated that one third of the Officers of the Sardinian Army are promoted from the ranks; the remaining two thirds, *i.e.* all young men entering the army as Officers must pass through the *Accademia Militare*. The regular course of study in this school lasts apparently for six years, shortly to be reduced to five years, and the earliest age at which it is *possible* now to enter is fourteen, the *usual* age of admission being fifteen or sixteen. Formerly boys entered at eleven and twelve, but this practice has lately been altered, to the regret of many Officers, who prefer the plan so commonly adopted abroad of training Officers to their business as soldiers from very early years.

Four years' course.

Age of Admission.

A School for all Arms.

The peculiarity of this school is that during a portion of the course it educates Officers for all Arms in common. The most talented pupils are then selected by examination for the Artillery and Engineers, which are the two favourite services, and indeed the most aristocratic corps in the Sardinian army. The number of the pupils is limited to 200, but it is rarely complete; at present there are 180 pupils. About half of these pay for themselves a yearly sum of 1,200 francs, 48*l*., the remaining half are supported, or partly supported by the Government. The system of *demi-bourses* prevails here as in France.

Numbers of the Students.

Annual payment.

Demi-Bourses.

Four classes.

Fifth class of Officer-Students.

The pupils are divided into four classes, according to the years of the course; a fifth class, contains those who have been just selected for the Artillery and Engineers, who work by themselves, chiefly at the higher kinds of drawing and the Differential and Integral Calculus, and Mechanics. These senior pupils are Officers, and have each their separate room. German is taught, and there is a Course of Italian Literature, &c., but no Latin is taught in any part of the school. The system of working (at least with the higher boys) is in rooms where eight or ten are united, and apparently there is something of the *Répétiteur* system.

Subjects, and method of instruction.

Discipline and internal arrangements. Barrack system.

The arrangements of the house are excellent. The pupils appear to be strictly confined to barracks during the week, but allowed to go out on Sundays. The discipline is said to have been relaxed of late years, and this is attributed by old Officers to a cause which will appear curious in England, viz., to the pupils having *any* holidays at all. This innovation upon the simplicity of the Piedmontese system of education was alleged to have encouraged distinctions between the richer and poorer pupils, and thus to have injured both the economy and the *Camaraderie* of the school. Great stress was laid here, as at other Military Institutions, on a strictness of discipline very unusual in England. The boys begin their work at half-past five o'clock, and work till seven; then they go to chapel for a short time, and breakfast and recreation follow immediately after. Both are concluded by eight, when they return to their studies for an hour and a quarter; then a quarter of an hour's relaxation is allowed, and the studies are resumed until eleven o'clock. An hour is then devoted to the schools of fencing, riding, gymnastics, or dancing. From twelve to a quarter before two o'clock is allotted to dinner and recreation, and then another hour is spent in the fencing, riding, gymnastic, or dancing schools. A quarter of an hour's recreation is again granted, and from three to half-past four o'clock study is resumed. A quarter of an hour's recreation follows, and half an hour is then given to military exercises, succeeded by another quarter of an hour's interval for rest. Two hours are then devoted to study—from half-past five to half-past seven o'clock. An hour is afterwards allowed for chapel, supper, and retiring to rest.

Monthly credits.

A monthly account is taken of their work, and the marks then given exercise an influence upon their places in the examinations which take place every year.

The following tables give a full view of the work of the pupils during their six years' course.

Royal Military Academy.

Distribution of the various Branches of Study in the different Years of the Course and General Time Table for the Schools.

Classes.	Subjects of Study.	Lessons. Months.	Lessons. In each Week.
First Year.	Catechism	8	1
	Arithmetic	1	6
	Plane Geometry	1	6
	Algebra, 1st Part	3	6
	Solids	3	6
	Italian Elocution	4	5
	History of Italian Literature	4	5
	French Language	8	5
	Caligraphy	7	2
	Soldiers' Drill	3	2
	Squad Drill	3	2
	Army Regulations	2	2
	Dancing	8	2
	Gymnastics	8	2
	Figure Drawing	8	2
	N.B.—This class will be abolished at the cessation of the present scholastic course.		
Second Year.	Catechism	8	1
	Algebra, 1st Part	8	3
	Solids	6	3
	Italian Literature	8	3
	French Language	8	3
	Battalion and Company Drill	2	3
	Chasseur Drill	1	3
	Garrison and Divisional Duty	2	3
	Law on Recruiting	1	2
	Figure Drawing	8	2
	Dancing	8	2
	Gymnastics	8	2
	Soldiers' Drill	2	2
	Caligraphy	4	2
Third Year, General Service.	Sacred History	8	1
	Rectilinear Trigonometry	8	3
	Geography and Ancient and Mediæval History	8	3
	Italian Literature	8	3
	French Literature	8	3
	War in Detail	4	3
	Company and Battalion Drill	5	1
	Chasseur Drill	1	1
	Rifle Practice and Gymnastics	1	1
	Topographical Drawing	8	3
	Fencing	8	2
	Gymnastics	8	1
Third Year, Special Services.	Sacred History	8	1
	Algebra, 2nd Part	3	4
	Rectilinear Trigonometry	1	4
	Spherical Trigonometry	1	4
	Algebra applied to Geometry	3	4
	Descriptive Geometry (the 1st 10 numbers)	5	3
	Geography and Ancient and Mediæval History	8	3
	Italian Literature	8	3
	French Literature	8	3
	War in Detail	4	3
	Company and Battalion Drill	5	1
	Chasseur Drill	1	1
	Rifle Practice and Gymnastics	1	1
	Topographical Drawing	8	3
	Fencing	8	2
	Gymnastics	8	1
Fourth Year, General Services.	Ecclesiastical History	8	1
	War in Detail	5	2
	Art of War, 2nd Part	3	2
	Artillery	5	2
	Fortification	8	3
	Physical Mechanics	8	3
	Topography	3	2
	Modern History, History of the Country	8	3
	German Language	8	3
	Army Regulations	3	3
	Military Accounts	8	2
	Italian Literature	5	2
	French Literature	2	2
	Gymnastics	8	1
	Riding	8	3
	Landscape Drawing	8	2
	Topographical Drawing	3	2
	Fencing	8	2
Fourth Year, Special Services.	Ecclesiastical History	8	1
	Infinitesimal Calculus	8	4
	Descriptive Geometry, 2nd Part	6	2
	Fortification	8	3
	War in Detail	8	2
	Modern History, History of the Country	8	3
	German Language	8	3
	Topographical Drawing	3	2
	Military Accounts	8	1
	Landscape Drawing	8	2
	Gymnastics	8	2
	Riding	8	3
	Fencing	8	2

ROYAL MILITARY ACADEMY—*continued.*

Class.	Subjects of Study.	Lessons. Months.	Lessons. In each Week.
Fifth Year, General Services.	Ethics	8	1
	Physical Mechanics	8	3
	Topography	8	2
	Art of War	5	2
	Artillery	6	2
	Landscape Drawing	3	2
	German Language	8	2
	Italian Literature	4	2
	French Literature	5	1
	Army Regulations	4	2
	Gymnastics	8	2
	Fencing	8	2
	Riding	8	3
	Military Accounts	8	2
Fifth Year, Special Services.	Ethics	8	1
	Calculus	8	4
	Physics	8	3
	Topography	8	2
	Art of War	5	2
	Artillery	6	2
	Landscape Drawing	8	2
	German Language	8	2
	Descriptive Geometry, 2nd Part	6	2
	Gymnastics	8	2
	Fencing	8	2
	Riding	8	3

PUPIL SUB-LIEUTENANTS.

Class.	Subjects of Study.	Lessons. Months.	Lessons. In each Week.
Sixth Year, Special Services.	Ethics	8	1
	Rational Mechanics	8	6
	Analysis	2	6
	Chemistry	8	3
	Architectural Drawing	8	2
	German Language	8	2
	Gymnastics	2	1
	Fencing	8	2
	Riding	8	3

GENERAL TIME TABLE FOR SCHOOL DAYS.

From 5 to $5\frac{1}{2}$, Rising, Dressing, &c.
„ $5\frac{1}{2}$ to 7 A.M. Study. From 7 to 8, Chapel, Breakfast, and Recreation.
„ 8 to $9\frac{1}{4}$, School of Science and Literature. From $9\frac{1}{4}$ to $9\frac{1}{2}$, Recreation.
„ $9\frac{1}{2}$ to 11, Ditto, ditto.
„ 11 to 12, School of Fencing, Riding, Gymnastics, Dancing, &c.
„ 12 to $1\frac{3}{4}$, Dinner and Recreation.
„ $1\frac{3}{4}$ to $2\frac{3}{4}$ P.M., School of Fencing, Riding, Gymnastics, Dancing, &c.
„ $2\frac{3}{4}$ to 3, Recreation.
„ $4\frac{3}{4}$ to $5\frac{1}{4}$, Military Exercises. From $5\frac{1}{4}$ to $5\frac{1}{2}$, Recreation.
„ $5\frac{1}{2}$ to $7\frac{1}{2}$, Study. From $7\frac{1}{2}$ to $8\frac{1}{2}$, Chapel, Supper, Dormitory.
„ 3 to $4\frac{1}{2}$, School of Science and Literature.
„ $4\frac{1}{2}$ to $4\frac{3}{4}$, Recreation.

II.—ARTILLERY AND ENGINEER SCHOOL.

(*Scuola Complementaria.*)

One special School of Application for Artillery and Engineers.

Length of Course.

Lodgings not Barracks.

THIS School, which is established in a large building in one of the suburbs of Turin, is a School of Application, intended to complete the special education of the Young Officers of the Artillery and Engineers, which the Cadets of those Corps have previously entered upon during their four last years in the *Accademia Militare*. Its course of studies occupies nominally two years, but really only eighteen months, after which the final examinations begin, and the pupils receive leave of absence. The Students do not live in barracks here, but the Inspector of the School seemed to think it desirable that they should do so. The exercises of the day commence, at eight o'clock every morning, with an hour's riding. A lecture then follows, which lasts for an hour and a half, from nine till half-past ten. The rest of the morning is left free till twelve o'clock, when the pupils return to the school till three, and where they study together in large classes in the same room; they have afterwards some military exercises till five, and are then free for the evening.

Numbers.

Little preference shown for one Corps over the other.

Engineers not employed on civil works.

Pay of the two Corps equal.

The number of pupils at the school is twenty; from ten to fifteen for the Artillery, the rest for the Engineers. The subjects of study (page 235), will show what difference exists in the studies of the two Corps, and we were told that very little preference was shown in the choice of the Students for one over the other. The Engineers do not appear to be at all employed in civil works; indeed, the Government does not allow them to be so, as there are sufficient fortifications in the kingdom of Sardinia to afford them constant employment. The pay of the two Corps is equal, and is very little above that of the Infantry, and the same as that of the Cavalry. The Artillery and Engineers (the *Armi dotti*) appear to be decidedly the favourite and aristocratic corps of the Sardinian army. They rarely enter the Staff Corps, and the reason assigned for this is their unwillingness to quit their own arm of the service. The position of the pupils on entering the Corps is fixed by the Final Examination alone, and is not influenced by marks previously given for industry and application during the course, as is the case in some of the French and German schools,—at the Polytechnic, for instance, and at Znaim. The only value of a high position in the Final Examination is that it gives seniority in the Corps.

Unwillingness to leave the Scientific Arms for Staff Service.

Seniority fixed by a final examination.

Such is the outline of the work at this school. The material accommodations consist merely of lecture-rooms in a large building; the pupils themselves, as we have said above, live in lodgings in Turin. We append the Official Decree for the Regulations of the School, together with the Royal Decree which founded it.

Turin, December 8, 1851.

ROYAL DECREE, in which His Majesty suppresses the School of Application, and institutes a Complementary School for the Officers of Artillery and Engineers.

VICTOR EMANUEL II., King of Sardinia, &c.

Considering the Sovereign Provisions of the 4th of May 1839, by which there was instituted in the Royal Military Academy a School of Application for the Officers of the Scientific Corps:

Considering our Decree of the 13th of May 1850, which regulates the admission of Officers into the Royal Staff Corps:

Considering the desirability that the Officers who pass from the Royal Military Academy into the Royal Corps of Artillery or into that of Engineers, should be, during the course of studies which still remains for them to complete, under the entire control of the General Commandant of one of the two corps just mentioned:

On the proposition of our Minister, Secretary of State for the Affairs of War, We have ordained and ordain as follows:—

ARTICLE 1.

Suppression of the School of Application.

§ 1. The School of Application, instituted in the Royal Military Academy by the Sovereign Provisions of the 4th of May 1839, for the Students admitted to the Royal Corps of Artillery, of Engineers, and of the Staff is suppressed.

ARTICLE 2.

§ 2. There is provisionally instituted in the Royal Artillery Corps, and under the orders of the General Commandant of the same, A COMPLEMENTARY SCHOOL for new Officers promoted for meritorious study of the said corps, and that of Engineers. Institution of the Complementary School.

ARTICLE 3.

§ 3. The direction of the School is intrusted to a Field Officer of Artillery, who will be answerable to the General Commandant for the proper working of the School, whether as regards instruction or discipline. Direction.

§ 4. Two Captains will be attached to the direction of the School, one from the Artillery, and the other from the Engineers, to be neminated annually.

ARTICLE 4.

§ 5. The scientific instruction is intrusted partly to Professors and partly to Officers belonging to the various Artillery divisions and establishments; the practical instruction to the latter and to Officers of the Regiments of Artillery. Instruction partly civil and partly military.

§ 6. The above-mentioned Professors and Officers will be assisted, and in case of necessity replaced, in their functions of instruction by other supplementary Professors.

ARTICLE 5.

§ 7. All the new Officers promoted for meritorious study will be attached to the Complementary School as OFFICER STUDENTS, for the purpose of following all its courses and the practical instructions which will be given there. Officer-Students.

ARTICLE 6.

§ 8. The Professors are effective, and assistant or supplementary.

§ 9. The *effective* Professors are nominated by Us, and receive a salary fixed by the Decree of their nomination. Professors, &c. paid and unpaid.

§ 10. The *assistant or supplementary* Professors are nominated by our Minister, Secretary of State for the Affairs of War, receive no salary, and supply from time to time the place of the effective Professors who may be wanting.

§ 11. The Officers of Artillery attached to the direction, and those of the regiments who shall be assigned by the General Commandant to the duty of instruction in the processes of manufacture in the factories, and to that of the practical instructions, shall receive no salary. Officers superintending receive no salary.

ARTICLE 7.

§ 12. The Professors and Instructors are under the immediate authority of the Director of the School, and address to him their reports and applications in every matter which has reference to their position in the School.

ARTICLE 8.

§ 13. The Officer Students of the Complementary School are subject to all the regulations and rules of discipline established by the Officers of our Army and of the garrison of Turin, and are under the immediate authority of the Director of the School.

ARTICLE 9.

§ 14. The examinations to which the Officer Students of the Complementary School will have to be subjected will be held by a Commission nominated by our Minister Secretary of State for the Affairs of War. Examining Body.

ARTICLE 10.

§ 15. A Council of Instruction and Discipline will be formed of all the effective Professors of the School and the Captains attached to the direction, and will be presided over by the Director of the School. Council of instruction and discipline.

Council of instruction and discipline. Its duties.

§ 16. This Council will be always convoked by the General Commandant of Artillery.

§ 17. Reports of the regular action of the School will be laid before the Council of Instruction on the part of the Director, stating the means which he proposes for bringing it to perfection.

§ 18. In the Council of Instruction will be discussed the changes proposed in the programmes and regulations which will be subsequently submitted to the Minister of War.

§ 19. The Council of Instruction proposes the regular distribution of all the instructions during the course of the Complementary School, as also the time-tables which suit them.

§ 20. It proposes also the rules to be followed in the examinations.

§ 21. In the case of grave faults committed by the students, the Council of Instruction will always be consulted on the proposed measures to be taken.

§ 22. Besides these fixed duties, the General Commandant of the Royal Corps of Artillery will also have the power of convoking the Council of Instruction, for the purpose of obtaining its advice in all those circumstances in which he may judge it convenient.

ARTICLE 11.

§ 23. An invalid Sergeant of Artillery will be attached to the Complementary School in the capacity of servant, to whom, in addition to the pay and allowances of which he is in possession, will be assigned an extra monthly pay of fifteen francs.

§ 24. And, in case of necessity, a second invalid Non-commissioned Officer of Artillery may be attached to the service of the School.

ARTICLE 12.

§ 25. Our Minister Secretary of State for the Affairs of War, will settle the programmes of the subjects to be studied in the course of the Complementary School, and give the proper orders for the internal regulation of the School, the duration of the course, and for the periods of the examinations, as well as all those others which may be necessary to give effect to the present decree, which shall be registered in the Office of General Control.

Given at Turin, the Eighth day of December 1851.

VICTOR EMANUEL.

A. LA MARMORA.

INSTRUCTIONS for the INTERNAL REGULATION of the COMPLEMENTARY SCHOOL instituted in the Royal Artillery Corps by Royal Decree of the 8th December 1851.

ARTICLE 1.—OF THE SUPERIOR COMMAND OF THE SCHOOL.

1. The General Commandant of the Artillery, being also first in command of the Complementary School, besides the duties settled by Royal Decree of the 8th December 1851, keeps at the same time the correspondence with the Minister of War, in so far as concerns the School in question.

2. He refers to that Minister all that has reference to the examinations, the studies, the variations in the programmes, the nominations of and changes in the instruction given by the Professors, and all those other measures which in the ordinary course require ministerial decisions and provisions.

3. The General Commandant of the Artillery gives those orders relating to the Complementary School which do not require ministerial decisions and provisions.

4. The General Commandant of the Artillery allots to the Officers of Artillery the communication of instruction in practical duties, and in the processes of manufacture in the factories and departments (*direzioni*).

ARTICLE 2.—OF THE DIRECTOR OF THE SCHOOL.

5. The Director of the Complementary School sees to the exact compliance with the regulations on the part of the Professors, Instructors, and Students.

6. The conduct of the students out of the School is also under the superintendence of the Director.

7. The Director of the School gives the daily orders relating to military musters, changes in the time-table, and instructions already approved by the General Commandant of the Artillery.

8. As President of the Council of Instruction and Discipline, the Director of the School lays its deliberations before the General Commandant of the Artillery.

9. The result of these deliberations will be embodied in appropriate statements of proceedings. These statements will be drawn up by one of the members of the Council itself in turn.

10. The Director of the School gives notice to the Professors and the Officers' Instructors of the time at which their part of the instruction will commence; to the Officers Instructors, in particular, he further points out the rules and regulations to be followed.

11. All the applications, notices, reports, appeals, &c., on the part of the Professors and Students, are addressed to the Director of the School.

On those of little moment the Director himself will decide, and those of greater importance he will lay before the General Commandant.

12. The Director will give his daily orders in writing, on a register devoted to that purpose, and will take care that those orders are communicated to all the Officer-students, and to the Professors and Instructors on duty. Daily order-book.

In these orders the Director will adhere to the regulations laid down in the daily orders of the "*Operai*" regiment, in so far as regards the military duties at which the students will have to attend, the dress, and general regulations of discipline.

13. The Director of the School will keep a register of the conduct of the Officer-students. Register of Conduct.

On this register will be noticed the neglects of duty, the punishments, absences, sicknesses, the activity and zeal shown in the Schools and practical instruction, the aptitude, &c.

14. Besides the particular reports which casual events may call for, the Director of the School will lay before the General Commandant once a month a detailed report on the progress of the theoretical and practical instruction; on the conduct, aptitude, and willingness of the students. Monthly Report.

15. The length of the arrests inflicted on the students of the Complementary School will be fixed by the Director of the School for light faults, and in the case of graver ones he will refer it to the General Commandant. Arrests.

16. During short absences the Director's place will be supplied and his duties performed by the first in rank, or the senior among the Military Professors and the Officers attached to the Complementary School. In the case of longer absences, provision will be made by the Minister of War on the report of the General Commandant.

17. The official papers which may arise will be kept by the Director of the School and by one of the Non-commissioned Officers attached to the Central Committee, without his being for that reason withdrawn from his special duties to be exclusively given up to the School.

Article 3.—Of the Captains attached to the Direction.

18. The Captains attached to the direction of the School are particularly charged with the maintenance of military discipline among the students, with the task of seeing that they are present in the study-rooms, during the fixed hours, besides the Schools, with receiving the applications, reclamations, &c. sent in by the students, with superintending their conduct, &c.

19. These Officers will assist the Director in every case in which they may be called upon to do so for the better working of the School.

Article 4.—Of the Professors and of the Instructors.

20. The Professors and Instructors are personally responsible for the teaching of the subjects contained in the programmes and regulation for the discipline of the students in School, for the daily drawing up of the notes and execution of the drawings, and for the constant presence of the students during the time of the instructions and lectures.

21. The Military Professors and Instructors will maintain constantly among the students the spirit of subordination and military discipline in all its force.

22. The Professors not possessed of military rank, when reproof is not sufficient to keep the students to their duty, will report the matter to the Director and to the Captains attached to the direction of the School, in order that more vigorous measures may be adopted.

23. At the beginning of every lecture, the Professors will satisfy themselves that the students have finished the notes preceding it, and the regulated tasks and drawings.

24. The Professors will also have the power of visiting with arrest students who are negligent in the execution of the notes and tasks, and those who exhibit a constant indisposition to work, reporting it to the Director of the School.

25. When the lectures are upon difficult subjects, it is the duty of the Professors sometimes to visit the students during the hours of study, for the purpose of explaining difficulties.

System of lecturing.

26. At the beginning of every lecture, the Professors will dictate to the students a summary of the lesson which they are about to explain.

27. At the commencement of their course of lectures, they will point out to the students the books and treatises to be followed.

28. At fixed intervals, as they shall judge it most convenient, the Professors will suspend the course of their lectures to satisfy themselves by questions of the attention given and the progress made by the students.

29. At the opening of their course, the Professors will notify to the Director of the School the hours which suit their engagements best for the giving of the lectures; these hours will be subsequently maintained unchanged throughout the duration of their course. These hours can only be selected out of those fixed in the general time table.

30. In case of any lectures having to take place out of the lecture-rooms of the School, they will give notice in time to the Director.

31. If they should consider any change in the programme necessary, they will give notice in writing to the Director of the School, so that he may be able to submit their propositions to the General Commandant.

32. The Instructors will exact of the students in the execution of the practical instructions and in the explanation of them, a demeanour perfectly military, and a tone of voice appropriate to the circumstance. All the students, without exception, should render themselves capable of executing the practical tasks and explanations now mentioned with the greatest perfection.

33. The Professors, as well as Instructors, in concluding their course of lectures, will transmit to the Director of the School a statement showing the degree of instruction acquired by the students, and their conduct in School; the credit for the instruction and for conduct will be given by means of two distinct integral numbers, selected from two to ten.

Article 5.—Of the Students.

Students. Disciplinary regulations.

34. The Officer-students of the Complementary School will be attached to and reckoned as part of the "Operai" regiment.

35. They will give to the Staff of the said regiment the address of their lodging.

36. The notices of sickness will be addressed to the Director of the School and to the Staff of the "Operai" regiment, by means of two distinct billets.

37. The billets of leave will be signed by the Colonel commanding the "Operai" regiment, but will be laid before him by the Director of the School.

38. The Officer-students will perform no duty, except picket duty on holidays, which will be regulated by the Staff of the "Operai" regiment, according to the arrangements which will be made between the Colonel commanding the regiment and the Director of the School.

39. The students will have to pay the same obedience and equal marks of respect and deference to the Professors not possessed of military rank as to the military superiors.

40. With reference to the studies, the tasks to be executed, the memoirs, the

discipline in the school-rooms, the students will carry out the orders of the Director, of the Professors, and other officers attached to the School. Disciplinary regulations.

41. The memoirs will be written daily as a sequel to each lesson received. They will be handed in to the Professor at the commencement of the following lecture.

42. The drawings and other tasks will be finished in the time which will be prescribed by the Professor.

43. The paper for the memoirs will be of the same size for all, conformably to the blank-books which will be prescribed to them at the beginning of the School.

44. The sheets of paper for the drawings will be of the dimensions and quality indicated by the Professor under the different circumstances. Before beginning the drawings, the sheets will be subjected to the inspection of the Professor.

45. All the work and memoirs will be executed by each student with his own hand; transgressions of this rule will be severely punished, and may occasion a reduction in the marks for merit in the examinations.

46. The tasks and memoirs ill done through carelessness or idleness will be done over again, if the Professor and the Director shall so direct. Measures of coercion will be adopted against negligent and ill-disposed students.

47. In school and study hours, every occupation extraneous to the courses daily followed will be prohibited.

48. All the students will be found at their place in school a few minutes before the hours fixed for the schools and studies.

49. Going out before the hours fixed for the duration of the Schools and studies is prohibited.

50. The students are forbidden to take out of the School their drawings in progress, unless by permission obtained from the Professor and Director.

51. On entering the School, the students will lay down their arms, their cloak and cap or chaco, in the ante-room in the place prescribed for each.

52. The students will provide themselves at their own expense with all the stationery and drawing materials which they require in the course of instruction, and in the same manner the books which will be indicated to them by the Director on the recommendation of the Professors.

53. The drawing tablets will be provided by the library of the Royal Artillery Corps.

54. The students will execute themselves, and afterwards explain and take the command of all the practical operations which are taught them by the Instructors. The discipline for these instructions is that established for soldiers, but with the rules of treatment for officers.

55. As in these instructions, a greater number of men than that of the students is required, soldiers taken from the regiments affected to garrison or active service, according to circumstances; but the students will always in these cases perform the most important duties.

Article 6.—Duration of the Course. Subjects and Programmes.

56. The course of the Complementary School will be terminated in a year and a half. The course of study: its length and subjects comprised.

57. The students belonging to two successive promotions will participate in the same instructions during the last six months of the first course, and the first six of the second course.

58. The subjects which will be taught to the Officer-students of the Complementary School are,—

a. Mineralogy and metallurgy.
b. Introduction to applied mechanics, and application of mechanics to machinery.
c. Theory of the combustion of powder; of the movement inside the bore; of the resistance of ordnance; of the volume, weight, and centre of gravity of ordnance; projectiles.
d. Use of artillery in war, construction of batteries, service in the field.
e. Permanent fortification.

Subjects of the course.

f. *Course of construction and of military and civil architecture.*
g. *Topography.*
h. *Geodesy.*
} For Engineer-Officers only.

i. Military bridges and passage of water.
l. Classified nomenclature, and drawing of artillery materials.
m. Manufacture of powder, fireworks, arms, ordnance.

59. The programmes relating to the teaching of these subjects are those annexed to the present instruction.*

60. If the Professors shall recognise the necessity and convenience of modifying the programmes, they shall lay detailed propositions in time before the Director of the School, who will submit them to the General-Commandant, in order to provide for the assembling of the Council of Instruction to discuss their opportuneness and suitability.

Article 7.—Practical Instructions.

61. Practical instruction will be given every day to the students of the Complementary School.

62. The object of this instruction is to render the Officers themselves familiar with the execution of the operations, and with the proper method of instructing Non-commissioned Officers and soldiers of Artillery.

63. These instructions, which will be, as far as possible, executed and explained by the Officers of the School, will consist of—

Gymnastics.
Riding, according to the regulations in force.
The pack of the infantry soldier, armament, infantry instruction.
Classified nomenclature of the various parts of horse furniture, convenient adaptation of them; pack of the cavalry soldier.
Principles of the physiology of the horse, and of veterinary science; care of horses.
Nomenclature and use of the field, mountain, siege, garrison, and coast material.
Lading of field and siege carriages, and mountain mules.
Service of field, mountain, siege, garrison, and coast artillery.
Driving and sectional drill, battery and brigade drill.
Regulations for marches, encampments.
Charges and compositions in use in the field, in sieges, and in garrisons.
Judging distance drill, practice; remedies applied to materials in the field.

Article 8.—Daily Duration of the Schools and Instructions.

Hours of study, &c.

64. The Officers of the Complementary School will be occupied at the most six hours a day inside the School.

65. Of the six hours, one hour and a half will be employed by the Professor in his lectures, the remaining four hours and a half will be employed in the drawing up of the notes, execution of work, and study.

66. Besides the above-mentioned six hours, every day in winter an hour will be allotted for practical instructions, and an hour and a half at least for the same practical instructions in summer.

67. The practical instructions are communicated by Officers of Artillery chosen from the three regiments stationed at Turin, according as the instructions given have a more direct reference to one rather than the other of those regiments.

Article 9.—Examinations.

Periodical examinations.

8. The examinations will be held at two different periods after the first six months, and the end of the course.

69. The examimnations held after the first six months will be take at the same time with those which conclude the course of the next senior class.

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*Not received.

Article 10.—Of the Invalid Sergeant acting as Servant.

70. The invalid Artillery Sergeant destined as servant in the Complementary School, for every contingency which may arise during the lectures and times of study, will be charged with seeing to the neatness and preservation of the place, and the objects therein contained.

71. He will be answerable to the direction of the library of the corps for the neatness and preservation of the places in which the School is held, and of all the objects and furniture existing in them.

72. Ten minutes before the hour for the entrance of the students into the School the rooms will have to be open and in order.

73. The invalid Sergeant servant will mark on a register kept for that purpose the precise hour of entrance and exit of each student.

74. He will further make a daily report on the damages to the furniture and rooms which he may have observed.

75. He will not permit the entrance of strangers into the rooms during the hours either of school or study.

76. He will afford all the services which may be required of him by the Professors and students inside the Schools.

77. He will lay the order-book daily before the students and Professors.

78. On no pretext must he absent himself during the hours of school and study.

79. When the lectures and studies are concluded, he will go over the rooms, and close the School, will take home the keys or consign them to some person to whom he shall be ordered to do so by the Director.

Article 11.—Furniture and Stores for the Schools.

80. All the stores and furniture necessary for the Complementary School will be given in charge to the library of the Royal Artillery Corps, and by it handed over into the keeping of the Director of the School, on receipt of an acknowledgment.

81. The necessary stores on the requisition of the Director of the School, will be provided by the General Army Account Office (*l'Azienda Generale di Guerra*).

82. The wood for warming the school, the oil, and lamps for lighting will also be provided by the said General Army Account Office, on the requisition of the Director.

Turin, Jan. 20, 1852.

The Minister Secretary of State,
(Signed) Alfonso La Marmora.

A true copy,
The Director of the School,
(Signed) A. Della Rovere.

III.—THE STAFF SCHOOL.

Incomplete character of the Schools.

The Staff School at Turin has only existed since the year 1850. Previously to that time the Staff was supplied by picked scholars from the *Accademia Militare*. The School still bears many marks of being incomplete, and some obvious faults of detail were pointed out.

Numbers of the Sardinian Staff Corps.

The whole Staff Corps of the Sardinian Army only consists of thirty-six Officers, viz. twenty-four Captains, and twelve of higher rank; no one of a lower rank than Captain being admitted even as attached to the corps, a regulation which appeared to be considered inconvenient.

The Sardinian Staff School bears more resemblance to the Austrian than to any other we have inspected. Officers are required to have served four years before their admission, as is the case in the Austrian Staff Schools, and they must not have exceeded their twenty-eighth year. Again, as in Austria, the Officers on leaving the school are ranged strictly in the order of merit, as tested by a final examination; and the ablest obtain appointments to the Staff in the same order. The Sardinian School has, however, some peculiarities, partly arising from the higher position which the Special Arms (*Armi dotti*) of Artillery and Engineers hold in Sardinia than in Austria or Prussia. The method of admission is as follows:—

Officers admitted on the recommendation of their Colonels.

An Officer requests his Colonel to recommend him for admission to the Staff School. Great caution seems to be observed in giving this recommendation; but having obtained it, an Officer has no further difficulty in entering the School. In consequence of the small numbers of the Staff Corps, the demand for entrance is not very great, and there is accordingly no competitive examination.

Numbers of the Students.

The numbers in the School have, during the first five years of its existence, varied greatly,—from fourteen or sixteen to four or six. A year (or rather eleven months) is the time occupied by the studies; the first six months being given to theory, the last five to practice. The theoretical work is that specified in the account of the course of lectures (*see* next page), viz. "Topography and Plan "Drawing, preceded by the necessary lectures in Arithmetic, Geometry, and "Trigonometry;" and the number of hours spent in the studies and exercises of the School is not excessive. The time thus occupied lasts from ten till three in the afternoon.

The amount of knowledge required for admission into the School is stated, in the "Note" of Colonel Petitti, to be an acquaintance with Geometry and Algebra, as far as Equations of the Second Degree.

Average number of annual appointments to the Staff.

The practical work consists in the usual surveys of countries, plans, &c. The young Officers are taken by the Inspecting Colonel of the School into the country, and worked hard for four or five months. There have hitherto been only places for one or two of these Officers on the Staff at the end of the year, and these (as has been already mentioned) have always been the most distinguished pupils of the School. The rest become teachers in the regimental schools. Officers leaving the Staff School do not appear to have a right to a step immediately (as in Austria) by virtue of their having been at the School; but the Sardinian system of making all the appointments above the rank of Major by selection gives them a prospect of advancement. Examinations are held in the School every three months, at which the Professors give marks of proficiency; these are combined with those obtained in the final examinations in determining the position of the pupils.

The Professors all military.

The Professors in the Staff School are all military men. The building is very good, and, although small, contains a library, instruments, museum, and all the apparatus for maps.

The following official documents will complete the account of the School:—

1. The regulation concerning the studies, issued October 1852.
2. The order of the day, with the time-table for the lectures.
3. Table showing the points of merit.
4. Table showing the forms of admission to the School.
5. Table showing the existing state of the Staff Corps.

Course of Lectures before the Royal Staff Corps.

Note, 16th October 1852.

(*Cabinet.*)

To the Generals commanding Military Divisions and Subdivisions, to the Commanders of Brigades, and the Generals Inspectors of the Royal Forces, to the Comptroller General of Army Finance, to the Commanders of Regiments of Infantry of the Line, of the Corps of Rifles, and of the Regiments of Cavalry.

Admission to the Staff Corps: competition open to Captains and Lieutenants two years' standing.

This ministry, intending, as it does, to propose the abolition in the Royal Staff Corps of the grade of Lieutenant, so that henceforward there should exist in it no Officers below the rank of Captain, cannot but recognise that the most convenient provision for supplying to that corps the means of filling up the vacancies which would occur in it would be found in throwing open to the Captains and Lieutenants of the various corps of the army, who can reckon two years of service in that grade, the right of presenting themselves for competition before a Commission for that purpose, which the ministry will take measures to assemble.

Preparation for the concursus.

But in order to place subalterns of the line and of cavalry in a position to acquire the preliminary knowledge necessary for the further prosecution of the studies which will be required, and to enable as well the ministry to know what Officers are to be called to the concursus, as the Officers to see if they can with advantage dedicate themselves to the studies which it involves, since there are many who are wanting in self-confidence, I have determined to ordain that—

In the Royal Staff Corps there shall be opened in November next a course of lectures in which shall be taught—

Subjects of lectures.

(*a*) Topography and Plan Drawing, preceded by the necessary lectures in Arithmetic, Geometry, and Trigonometry, by means of which the young Officer may arrive at the perfect mastery of this branch of education.

(*b*) All that concerns Military Studies and the various regulations both of the army and administration as well as riding.

This course will conclude after the termination of the period of field duty in the approaching year, in which the Officers under command will take part according to the destination which the ministry will allot to them.

Quarterly report of proficiency.

During the course these Officers will be bound to execute those tasks which will be required of them, by which the degree of ability acquired will become apparent. At the end of every quarter the General Commandant of the said Royal Corps will assemble together the Professors from whom he will receive an exact report of the manner in which the instruction is progressing, and a tabular statement will then be compiled, in which the Officers under command will be described in order of merit, marking to each the *mean number* of points obtained in the course of the quarter.

Officer-Students to receive their pay and an additional gratuity.

For the time during which the Officers under command will be absent from their corps, they will continue to receive pay and allowances according to the arm to which they belong, as well as the gratuity of 300 francs as compensation for the increased expenses to which they will be subject.

The most distinguished may compete for Captaincies on the Staff.

At the conclusion of the course, all the said Officers, without exception, will have to return to their respective corps, but in the meanwhile an exact report on the instruction given will be transmitted by the General Commandant of the Royal Staff Corps to the ministry, exhibiting the names of those Officers who, by reason of the greater distinction obtained by them, are recognised as fit to be admitted to competition for the post of Captain in the said Royal Corps in case of vacancies.

The names of these Officers will be made known by the ministry to the Commanders of the regiments to which they belong, in order that they may avail themselves of their services, and thus call into use the superior knowledge acquired by them to the advantage of the corps, giving them thus an opportunity of affording proof of the information they have acquired, and of executing new labours which, when terminated, will be transmitted to the ministry, which will thus perceive what progress they are making and the goodwill which they continue to evidence in profiting by the advantages offered them.

Appointment of Officers as Instructors.

1. The General Commandant of the Royal Staff Corps will provide for the designation of these Officers whom he shall think fit to set over the instruction in the various subjects during their course, and at the same time move them to draw up the programme of study for the section entrusted to each.

2. The Commanders of regiments of infantry of the line, as well as those of the regiments of Cavalry and of the corps of Rifles, will have to transmit to this ministry the list of Officers who are desirous of being summoned to Turin in order to profit by the course which is about to be opened, keeping, however, strict account in the propositions which the said Commanding Officers are invited to make of the regulations contained in the circular despatch of the 28th July 1851, 32 (*see* the Military Journal, page 233, of the second part for the year above cited), Nos. 1, 2, 3, 4, 5, and not allowing themselves to be guided in this by other motives than the greater advantage of the Royal service, and the promotion of the interests of those Officers whose future career offers the highest promise.

The above-mentioned table, in which it must not be omitted to comprise those Officers who in the actual inspection were pointed out to the General Inspectors as more especially deserving of this favour, will have to be transmitted by the Commanding Officer of corps at the earliest opportunity to this ministry, and knowing as I do their zeal and exactitude, I do not doubt that they will make their propositions with promptitude and impartiality.

I have besides a firm confidence that the young Officers will hasten eagerly to avail themselves of the advantages which are thus offered to them, since even when, either from a scarcity of places, or from other reasons, they do not succeed in obtaining admission into the Royal Staff Corps, at all events it is certain that an occasion is presented to them not only of acquiring fresh knowledge, or at any rate of perfecting that which they possess, but also of making themselves favourably known by the attitude which they exhibit; besides that, on their return to their corps at the termination of the course, they enable their superior Officers to make use of them with profit in the various instructions which are there given, and thus obtain greater opportunities of distinguishing themselves and acquiring merit towards a more advantageous progress in the career.

The Minister Secretary of State,
A. La Marmora.

Note, No. 142, 10th October 1854.

Educational qualifications for admission.

Besides the rules laid down in the note above cited with reference to the Officers who desire to be admitted to the course of studies at the Royal Staff Corps, it was prescribed that they must, in order to obtain such admission, be acquainted with Arithmetic, Geometry, and Algebra, as far as Equations of the second degree. On the other hand, the corps will also be able to propose those Officers who have passed the age of twenty-eight years, provided that they otherwise satisfy the rest of the conditions laid down. In this point accordingly the disposition of No. 1 of the Circular Despatch of 28th July 1851, (Military Journal, Part II. page 233,) remains modified, and No. 2 of the other Despatch, above cited, of the 16th October 1852, in force.

For the Minister Secretary General,
A. Petitti.

Order of the Day.

Subordinate authority of the School.

The undersigned General Commandant desires to inform the Officers of the Army who are this year assembled with this Royal Corps for the purpose of assisting at a course of studies fixed according to a programme, arranged for that purpose, of the regulations to which they will have to conform during this their destination.

Director of the Military Institute.

The above-named Officers are placed under the special direction and surveillance of the Director of the Military Institute, to whom they will have to look for everything connected with the studies and with the discipline, subordinate to the orders of the General Commandant.

Captain Inspector.

The Director will have the right to avail himself of the services of the Captain Inspector to assist him in the various duties of such service. The said

Officers will be under the obligation of attending punctually at the fixed hours, either at the office of the Royal Corps, or in any other place where any lecture or class may be held.

No one can be dispensed from any obligation incumbent on him, except by the Director.

Their applications and reports will be conveyed to the Director through the medium of the Senior Lieutenant. The same Officer will mark upon a register devoted to that purpose the names of those not present, and the cause of their absence, of which they will be obliged to give early information. Senior Lieutenant.

The order to be observed for the various lectures, and the time to be employed, will be determined according to an appropriate time-table.

The arrangements will be those fixed by the General in Command of the Division, and no other. Since, however, the Officers are bound to attend at the office during the forenoon, they will arrange so as not to contravene superior orders.

Every one will be obliged to deliver in writing to the above-named Senior Lieutenant, to be deposited in the office of the Secretariat of the Royal Corps, the precise place of his abode, with the number of the door and of the floor, as also to give notice of any change in this respect.

The undersigned trusts to the zeal and good feeling of the Officers for the exact observance of the above.

The General Commandant,
(Signed) Della Rocca.

Time Table for the Lectures.

Arrival at the office, 10 A.M.
Departure from the office, 3 P.M.

Days of the Week.	Hours. From	Hours. To	Subjects of the Lectures.
Monday	10	12	Topographical Drawing.
	12	1½	Topography.
	1½	3	Art of War.
Tuesday	10	11	Fortification Drawing.
	11	12½	Fortification.
	12½	3	Topographical Drawing.
Wednesday	10	12	Topographical Drawing.
	12	1½	Topography.
	1½	3	Art of War.
Thursday	10	11	Fortification Drawing.
	11	12½	Fortification.
	12½	1½	Fortification Drawing.
	1½	3	Art of War.
Friday	10	12	Fortification Drawing.
	12	1½	Topography.
	1½	3	Art of War.
Saturday	10	11	Fortification Drawing.
	11	1	Fortification, followed by Fortification Drawing.
	1	2	Topography.
	2	3	Topographical Drawing.

Every day, from 8 A.M. to 9 A.M., Riding School. The Major Director.

TABLE OF POINTS OF MERIT obtained in the different subjects of study by the Officers of the Royal Army attending the course of studies of the Royal Staff Corps.

To be compiled at the end of every Quarter.

Family and Christian Name.	Rank.	Corps.	Points of Merit in the Studies.								Average of the Points of Merit. (1)	Remarks.
			Topographical Drawing.	Trigonometry.	Topography.	Linear Drawing.	Fortification.	Art of War.	Riding.	Zeal and Diligence.		

(1) The maximum of the points of merit is 10.

ROYAL STAFF CORPS.

List of Proposition of
for promotion
for admission

Number.	Family and Names.	Rank.	Date of Commission to such rank.	Corps to which he belongs, or the arm to which it is proposed that he should be transferred.	Remarks on fitness, or the contrary, made by the Commander of the Corps.

ROYAL STAFF CORPS

(1) Indicate the rank, family, and name.

The (1)
son of and of ,
born at province of ,
the , by religion ,
marriageable, or married by Sovereign authorization contained in the Despatch ( )
the with (3)
has no children, or has male, and female;
is in possession of property approximately worth

(2) Indicate the date, the No. of the Despatch, and the Division.

(3) Indicate the name and family.

Entrance into the Service, and last promotion.	Date.		
	Day.	Month.	Year.
(4) Note if in this or in another Corps. Entrance into the Service (4) - - - -			
Promoted to the rank of - - - -			

Has been on Foreign Service, *i.e.*, in from
to , where he arrived at the grade of

	In the Army.	On Foreign Service.
Years of Service - - - - - -		
Campaigns - - - - -		
Wounds - - - - - -		
Decorations - - - - - -		
Honourable Mentions - - - - -		

Physique :—

If the constitution is robust, sufficiently strong, or weak -
If the sight is good, acute, or short - - - -

Intellectual Qualities :—

If the intelligence is prompt, clear, reflective, and the mind orderly or confused.
If he is ready of speech, or uncommunicative - -

Moral Qualities :—

If he is honourable, and of a good disposition, with much or little expansion of character.
If of conciliatory or rough manners - - - -
If peaceable, quick, or irascible - - - -
If active, resolute, authoritative, timid, or feeble - -

Education :—

What degree of instruction he has arrived at in mathematics, in the theory and practice of surveying.
What ability in plan-sketching and topographical drawing.
If he cultivates any other branch of knowledge connected or unconnected with the Institute itself, and what.
If he is master of the Italian and French languages, so as to speak and write them with facility and correctness.
If he is acquainted with, and if he can speak, other languages
If he is addicted to study - - - -

Conduct :—

If his behaviour is dignified, as becomes a soldier and a citizen

If he enjoys the goodwill of his superiors, the esteem of his comrades and inferiors.

Mode of discharging his Duty :—

If he discharges his duty with exactness and zeal, or remissly and ill.

Particular Aptitude :—

If he is more especially fitted for the duties of the surveying, topographical, or military branch of the service.

If he has shown aptitude for teaching - - -

If he is adapted for progress in the Corps, or in the Infantry or Cavalry services.

Miscellaneous Information :—

N.B.—Under this head will be inserted those notices which, finding no place under the preceding heads, contribute towards a fuller information respecting those Staff Officers who, in consequence of circumstances and duties special and unconnected with the service of the corps, may afford ground for special mention.

Signature of the Members of the Commission.

Turin, day of

TABLE SHOWING THE EXISTING STATE OF THE ROYAL STAFF CORPS.

GRADES.	Number of Officers of every Grade.		Deficiency.	Excess.	Statement of the Causes of Deficiency or Excess in Numbers.
	Determined by the Table assigned to the Corps sanctioned with approbation of the Account of the Year 1852.	Existing.			
Major-General Commandant -	1	1			
Colonels - - - - -	3	4	–	1	By the promotion of Lieut.-Col. N.N.
Lieutenant-Colonels - -	3	3			
Majors - - - - -	5	5			
Captains — 1st Class - -	12	10	2	- -	By the death of Capt. N.N., and the promotion to a majority of N.N. in the Infantry.
Captains — 2nd Class - -	12	9	3	- -	By the death of Capt. N.N., and two former vacancies.
Major, charged with the Records, Accounts, and Library.	1	1			
Captain of Infantry, Secretary	1	1			
Lieutenants of Infantry attached	2	2			
Clerks - - - - -	–	1	–	1	
	40	37	5	2	

MODE OF RECRUITING.

At the end of every year, while the Commandant of the Corps, with the help of the Field Officers of the same, compiles and sends to the Minister of War the statements showing the character and conduct, and the lists of proposals for promotion of the Officers of the Corps; he transmits also the lists of proposition for admission into the Corps of Captains or Lieutenants of other Corps who are possessed of the required qualities, and are desirous of entering into the same. These Officers are selected amongst those who have more especially distinguished themselves in the preceding years in the course of studies of the Royal Staff Corps, and amongst those of the Artillery and Engineers, who, on making the application, after information demanded and obtained, are considered fit to be admitted.

IV. THE SCHOOLS OF IVREA AND PINEROL.

The requirement of professional study from Officers after entrance into the Army is a point almost peculiar to the Sardinian Service. The *principle* of the Prussian Division School is, indeed, almost the same as that of the two Schools we are about to describe; but the examination for which the Division Schools prepare is a qualification for obtaining a commission, and not (like that of the Sardinian Schools) for subsequent promotion. And this difference is partly owing to an obvious cause, the slowness of promotion in the Prussian Service. If the Division Schools and their examination were placed before the promotion to a Captaincy, the candidates attending the School would be in most cases nearly forty years of age.

Some instruction in Topography is given to the Officers of every Regiment in the Sardinian Army, under the direction of the Chief of the Staff of the Division. Care is taken to render the teaching uniform throughout the Army, and it may be considered as a preparation for the more systematic instruction given in the Schools of Ivrea and Pinerol. The former of these is intended for the Infantry; the latter for the Cavalry. Every Officer, excepting those of the Special Arms, must have passed a year of study in one or other of these Schools, as well as a subsequent examination, before he can obtain a Captaincy.

The studies are mainly practical as may be seen from the "Prospectus of Instruction" annexed. Topography, Field Fortification, and Secondary Operations are the only branches of Military Science in which instruction is given; and upon these much care appears to be bestowed.

One-third of the Officers of the Sardinian Army are promoted, as has been mentioned, from the ranks. Accordingly, a class has been recently added to the School of Ivrea, intended exclusively for the Education of those Non-comissioned Officers who aspire to a Commission. This class is to be common to Infantry and Cavalry.

It is unnecessary to draw attention to the importance of the Institution described. We regret, indeed, that the School of Ivrea was not in operation when we were in Turin; but its Programmes and the Official Regulations for its working have been supplied by the kindness of Mr. Erskine; and we believe they will be found to confirm our opinion of the interesting character of the School.

The following Prospectus of the studies pursued at Ivrea may serve to introduce us to the Regulations of the School:—

Prospectus of Instruction to be given to Lieutenants in the Military School of Infantry.

Soldier's Drill, Squad, Company, Battalion, and Chasseur ditto, &c.
Fencing with the Bayonet.
Exercise of the various Arms, &c.
Musketry Practice.
Regulations of Discipline, Garrison and Field Regulations, Army Accounts.
Secondary Operations of War.
Topography.
Field Fortification.

School of Topography.*

Note . November 3, 1853.

(*Cabinet.*)

In order to effect those improvements which experience has suggested in the action of the Schools of Topography for some years established with special regulations in the different garrisons, and generally recommended in the Syllabus of Instruction for the Infantry of the line (*Military Journal*, 1850, first half-year, page 250), I have determined as follows:—

* These Regulations, originally intended for the Schools of Topography in the different Garrisons, are here introduced in consequence of their obvious connexion with the subjects taught in those of Ivrea and Pinerol.

Article 1.—Period for the Schools.

Length of Course each year.

§ 1. Since the period fixed by the above-mentioned general Syllabus of Instruction for the lessons in Topography turns out to be somewhat inappropriate, especially in the case of the Cavalry, as well on account of the shortness of the days, which is little favourable to the labours which are being executed in the field, as by reason of the many occupations which are entailed on the Officers by the arrival of the new levies, it is decided that such instruction shall take place from the commencement of March till the end of July.

This will be obligatory on Officers who have not passed the age of thirty years.

Those Corps, however, who may think that they can thus employ themselves in the winter also for the hour or so which may remain over after the other occupations of the Officers, shall have the power of establishing, from the beginning of November, a school, in which drawing and other preliminary acquirements may be taught.

This School will be attended especially by beginners and the less educated, who will thus be able better to profit at the beginning of March by the lectures given to the Officers more advanced in this study.

Article 2.—Establishment and Division of the Schools.

§ 3. The Schools will be instituted for regiments or brigades, according as the General commanding the Division shall determine, upon the report of the Chief of the Staff, regard being had to the Director who can be assigned to them and the opportunities afforded by the situation.

§ 4. In cases, however, where it may be convenient, they can institute Divisional Schools as well, which will be attended by the Officers of the different corps already more advanced in the study.

There they will be exercised, by direction of the Chief of the Staff, in the various subjects taught in the School, especially in the application upon sketches of themes of secondary operations of war, and will be taken into the field to execute surveys on the spot with the instruments and by the eye.

Regimental and Brigade Schools of Topography.

In this case in the Regimental Schools the less educated officers will be trained under the direction of Officers who have given proof of sufficient capacity.

§ 5. The Officers of the Detachments of Cavalry or of the Rifles, for whom it may not be convenient to establish separate schools, will attend those schools of their garrison to which they are assigned by the General Commandant of the Division upon the proposition of the Chief of the Staff.

Article 3. Order and Development of the Instruction.

§ 6. In the different Schools will be observed the plans of study and the regulations contained in the Instruction upon Topography, published in 1852, by the Royal Staff Corps.

System of practical Instruction.

The explanations given will be accompanied, *pari passu*, by exercises in drawing; the pupils will be exercised in drawing not only with the pencil but also with the pen; the conventional signs, the writing, &c., will be exactly conformable to the models annexed to the Instruction above cited.

§ 7. Since the pupils will have acquired the necessary knowledge of drawing, and the first elements of the theory, it will be well to exercise them on the ground, first with the instruments, and then without them, supplying the remaining theoretical knowledge on rainy days and those allotted to repose.

§ 8. In order that the importance of this branch of instruction may be the better known, the pupils will be exercised at the end of the course, upon themes of narratives, descriptions of positions, collocation of advanced posts, &c.

They will accompany their papers by corresponding sketches.

Surveys.

§ 9. From the Schools of Cagliari, Annecy, and Alessandria, drawings representing the environs of those cities were by an idea, which deserves approval, transmitted to the ministry. I wish that this example may be imitated in those other cities whose environs have not been yet surveyed; and I intend hereafter to communicate to the Schools there established the dimension of the paper and the scale on which the subjects must be reproduced in design.

Article 4. Direction and Discipline of the Schools.

Annual Reports and Transmission of the Work of the Pupils.

Government of the Schools of Topography.

§10. Subject to the exalted direction of the General Commandants of Division, the Chiefs of the Staff will have the responsibility of the instruction in Topography, and will exert a vigilant care for its efficient working, providing for the maintenance of its uniformity, and promoting those arrangements which may conduce towards its progress.

§11. At the commencement of the course, the Chief of the Staff will compile the list of all the Officers who attend the Schools, in conformity to the classification which he will have made of them.

He will thereupon cause to be transmitted to him by the Directors of the schools every month, and even at shorter intervals, a table showing the absences of officers and the reasons which have caused them, in order that he may be able to point out to the Commanders of the respective corps those Officers who are absent from the School somewhat frequently.

§12. In the case, however, of the schools being regimental, the statement just mentioned will be transmitted by the Directors directly to the Commanding Officer of the regiment, who will thereupon stimulate those absenting themselves to the performance of their duty.

§13. In concert with the Commanding Officers of regiments, the Chief of the Staff will arrange the time-table of the Schools in such a manner as that each Officer may be able to attend three times a week, an arrangement which is not in the least irreconcileable with the various duties to which the Officers must attend, as appears from the experience of those corps whose Commanding Officers have successfully aimed at the progress of this branch of education.

Yearly report of individual progress.

§14. On the termination of the course, the Chief of the Staff will compile, with the assistance of the various Directors, a tabular statement indicating the names of the Officers attending the Schools, their assiduity and progress, noting further, in a report for that purpose, all relating to the School with which it may be desirable that the Minister should be made acquainted.

Yearly report of progress.

§15. The said report, with the list annexed, will be thereupon sent to the Minister, through the medium of the General Commandant of the Division, together with the papers and specimens of the drawings executed by the pupils.

Specimens of work sent to the Minister.

The specimens and drawings just mentioned must in every School be all of the same dimensions.

Upon each specimen and drawing must be indicated the name of the Officer who executed it, and the regiment to which he belongs, and each must be further countersigned by the Director of the School.

§16. In those garrisons where the Chief of the Staff is not resident, the propositions and reports which he would have to make or transmit to the General Commandant of the Division, will be made or transmitted by the Commanding Officers of Corps instead, so far as concerns the schools to be established in their respective corps.

The other attributions which by these present dispositions are assigned to the Chiefs of the Staff will be exercised according as may be judged most convenient by the Commanding Officer of the regiment in which the school is instituted, by a Field Officer of the regiment itself, or else by the Director of the School.

§17. The reports and the work of the Military Schools of Infantry and Cavalry will be addressed immediately to the Minister by the Officer commanding those establishments.

Article 5.—Furniture for the Schools—its Provision and Conservation.

§ 18. Inasmuch as this Ministry is careful to provide the Schools of Topography with the instruments necessary for the practical training upon the ground, it makes known henceforward the implements with which they must be provided, at the charge of the Treasury, in cases where they do not already possess them, viz.—

Small tables, with desks.
Seats or stools.
Slate, with stand.
2 pieces of Indian ink.

2 ditto of French blue.
2 ditto of gum.
2 tablets of carded wool.
1 case of mathematical instruments.
2 plane rulers of one metre each, besides some rulers of various dimensions, the necessary paper for themes, &c.
2 penknives.
Some pencils.
1 paper of steel pens for drawing.
Half a bundle of crows'-quills.
Chalk for the slate, and sponge.
Inkstand, with ordinary ink.
2 crayons (*coulé*) of No. 2.
2 ditto of No. 4.
2 pieces of Indian rubber.

§ 19. The objects above indicated, and all the others which will be kept in each school, will remain in the custody of the Director of the same, who will render an account of them to the Chief of the Staff, who will be security for them.

§ 20. The small tables, stools, and slates will be provided by the Chief of the Staff, in concert with the Commissary of War, paying attention to those economies which they may be able to effect, by making use of those articles which are already disponible in the garrison.

The Chief of the Staff has also powers to provide for the small expenses for renewals and repairs which may occur in the schools, for which the Ministry will take care to reimburse him when he shall have forwarded them the account for the same.

§ 21. The Chiefs of the Staff will also, with the assistance of the Commissaries of War, compile an inventory of all the articles existing in the schools, and will transmit it to the Ministry through the medium of the Divisional Commandant, indicating the further supplies which it is proposed to make, so as to complete the furnishing of the school, and giving information of the propositions which may be made for those supplies which they would not be competent themselves to provide.

§ 22. In all that concerns the schools established in the garrisons where the Chief of the Staff is not resident, the functions assigned to that Officer by the preceding sections 19, 20, and 21 will be exercised by the administrative councils of the corps in which the schools are instituted.

§ 23. However, as regards expenditure and supplies for schools in those cities whose garrison consists of one regiment alone, and where there is no troop of any other corps or detachment, this ministry reserves to itself the right of ulterior determination according to the state and the wants of the said schools, and in the meantime provision will be made in the manner hitherto practised, the Commanding Officers of regiments endeavouring to give to such schools all the developement possible, especially in the theoretical branch, and in lessons in drawing, according to the rules indicated in the instructions published by the Royal Staff Corps.

§ 24. The expenses which the Military Schools of Infantry and Cavalry will incur for the articles above mentioned will be at their own charge, and they will meet them with the funds assigned to this object in the respective categories of the military account.

§ 25. The Officers will provide at their own expense the paper, pens, crayons, compasses, and pencils which they individually require.

Those who may wish to provide themselves with a case of mathematical instruments can have recourse to the ministry through the medium of the Director of the School, and of the Chief of the Staff or Administrative Council. The ministry will thereupon, as was the practice last year, charge the Royal Staff Corps to make the acquisition, so as thus to obtain with greater ease from the furnisher some reduction in the price.

This price will be discharged by the Officers as they shall prefer, either at once, or by means of a small monthly stoppage of their pay.

I warmly recommend the Chiefs of the Staff and the Commanding Officers of Corps to devote themselves to the task with that solicitude and zeal which this branch of military education deserves, in order that the fortunate commencement, which it has already made, may develope itself continually more amply in all that is necessary for making it of real utility to the Army.

Table of Points of Merit for each of the Officers who may attend the Practical Course of Topography.

Family and Name.	Rank.	Regiment.	Zeal and Diligence.	Behaviour.	Expedition in the Works executed.	Ability.								Notices of Character.	Recapitulation in Order of Ability.				
						In Surveying with the Square.	In Surveying with the Compass.	In Surveying with the Plane-table.	In Surveying at Sight.	In Observations with the Paper in Hand.	In the Compilation of Descriptive Notices.	In the Compilation of Itineraries.	In Topographical Drawing.		Special Aptitude, and how they may be employed with utility.	Family and Name.	Rank.	Regiment.	Remarks.
															Fitted in time of war, or in other circumstances for Offices attached to the Staff.				
															Fitted for giving instruction in Topography at the Army Schools.				
															Fitted as Draughtsmen to be employed in the Topographical Office of the corps.				
															Apt and expeditious in plan-drawing with the plane-table without help.				
															Fit to take observations by themselves with paper in hand.				
															Fit to make a survey by themselves at sight.				

General Syllabus of Instruction for the Infantry of the Line.

(8th April 1850.)

Months of November, December, January, February and March.

Recruits will be kept separate from the seniors during these five months in all the instructions (except the drills).

They will be instructed progressively once a day in soldiers' and squad drill.

They will attend daily the gymnastic exercise and the school of reading and writing.

N.B. As they shall progress by degrees in the various branches of instruction, they will take their part in the service, at first on duty where arms are not required, and afterwards with their arms, as much as possible always upon public holidays.

Seniors will have to attend the school of reading, writing, arithmetic, and gymnastics daily.

The recruits as well as the seniors will be prepared for the practice range, during the months of February and March, by aiming at the butt and firing at the candle.

The Officers, especially the juniors, will be encouraged to exercise themselves in gymnastics, and to frequent the School of Topography.

The Captains will be taught riding as much as possible where they are in garrison with Cavalry.

In the months of February and March the Officers will be further prepared in the appropriate theory, with a view to the instruction of the following months, and all without exception will have to practise firing with the rifle.

April and May.

There will be no further distinction made between the recruits and seniors.

They will pass successively through soldiers', squad, and company drill, bayonet exercise, and rifle practice at the butt.

The school of reading, writing, and arithmetic, and gymnastics, will be continued at least for the lower classes.

The Captains will give instruction to their companies, especially in bad weather, on the subject of packing necessaries, and on the general behaviour of the soldier under different circumstances on and off duty, showing them also the manner of making reports in a few clear and concise words.

The Officers will be prepared by the appropriate theoretical training for the instruction of the following months.

The School of Topography will be continued as much as possible for the Officers who desire to attend it.

June, July, August.

They will pass successively through battalion drill and regimental and brigade manœuvres.

The rifle practice at the butt will be continued.

The *Chasseur* exercise will be taught.

The swimming school will proceed with the utmost possible activity.

The school of reading, writing, and arithmetic, and gymnastics will be continued at least for the lowest classes, as much as least as the instructions in other subjects, and especially swimming, permit.

The Generals of Brigade will explain theoretically to the superior Officers and Captains, and these latter to their own companies, the nature of service in the field.

September.

By frequent marches instruction will be given in field service, practical in its nature, and separate for every arm.

Manœuvres and evolutions appropriate to the ground will be gone through.

The troops will be disposed for the defence of a village or a position, of a stream, or the like.

October.

The instruction in the field will continue as much as possible, and especially in the garrisons where troops of different arms are quartered, one part of the force can be opposed to the other, and, where the service of the place permits it, by calling in the assistance of the National Guard, the garrison will be able entirely or in part to absent itself for two or three days.

General Rules relative to the Instructions.

1. As far as is possible the soldiers should receive at least two lessons in the day.

2. In the months of April, May, June, July, and August, the drill in the *place d'armes* will take place only once a day, the other will be in the barrack or the neighbourhood.

3. The Officers should give the instructions themselves, and should never appear as idle spectators before the soldier.

The subalterns will themselves conduct the soldiers' and squad drill, and the bayonet exercise.

The Captains will be careful to instruct their own companies. At the rifle practice all the Officers of the Company should be present and interest themselves for the good working of so important a subject of instruction.

4. During recreation times, and in all those kinds of instruction which do not require silence and immobility, the Officers will be careful to converse with their inferiors, and to study their character and qualities, praising and encouraging the good to do well, and visiting with words of blame more or less severe those who are ill-regulated in their conduct.

5. In order to interrupt as little as possible the course of the instructions, the Colonels and Generals of Brigade will avail themselves of the festivals accurately to review the men before and after mass.

6. In forts the Infantry will be exercised at the service of guns according to the directions which will be given to the Officers of Artillery commanding in them.

7. Some Non-commissioned Officers in every regiment will be trained as the carpenters for making cartridges.

8. In the interior of the barracks the men will be encouraged to amuse themselves, and be gay, rather than to loiter about in idleness. It will be most advantageous to introduce singing to music, as was done in the camp of 1846.

9. In the month of August, Staff Officers will be despatched to the principal garrisons who, being attached to Generals of Brigade and Division, will prepare with them the projects and plans for the field instructions of the months of September and October. These Staff Officers are further particularly charged to study the environs, and to point out in reports for that purpose the most important military positions, and the mode of occupying them.

10. Appropriate instructions concerning the rules to be observed in the rifle schools, concerning the swimming school, and the exercises in the field will be forwarded at the proper time.

LAWS ON PROMOTION.

Turin, February 2, 1856.

LAW relative to the admission of CIVIL ENGINEERS to the post of SUB-LIEUTENANTS in the ARTILLERY and ENGINEERS.

Victor Emanuel II., King of Sardinia, &c., &c., &c.

The Senate and the Chamber of Deputies have adopted;
We have ordained and ordain as follows:—

SOLE ARTICLE.

If during the course of the present war, the Institutes of Military Education do not supply the sufficient number of Officers of Artillery and Engineers, the vacancies happening among the Sub-lieutenants of those corps which are not reserved for the Non-commissioned Officers of the arm in which they occur may be filled up by Engineers who have graduated,* or even by students who have passed the examinations of the third year of the mathematical course in one of the Universities of the State.

The graduated Engineers will, so far as the exigencies of the service allow, be destined in preference for the Corps of Engineers.

Military men, of whatever arm of the service, may also be admitted as Sub-lieutenants in the above-named corps, on passing the examinations in the subjects prescribed for the third year of mathematics in the State Universities, and according to the rules to be laid down in the regulation for that purpose.

The latter as well as the former will have to satisfy those conditions which will be determined by Royal Decree.

We ordain that these presents, confirmed by the Seal of the State, be inserted in the "Collection of the Acts of the Government," commanding all whom it may concern to observe them and cause them to be observed as part of the law of the State.

VICTOR EMANUEL.
GIACOMO DURANDO.

Turin, March 30, 1856.

LAW modifying the Rules respecting Promotion to the Rank of LIEUTENANT in the INFANTRY and CAVALRY.

Victor Emanuel II., King of Sardinia, &c., &c., &c.

The Senate and the Chamber of Deputies have adopted;
We have sanctioned and promulgate as follows:—

SOLE ARTICLE.

In time of peace, and in the Infantry and Cavalry services, the promotion to the rank of Lieutenant will devolve upon the Sub-lieutenants of the respective service four out of five times, according to the order of seniority, and the fifth by selection.

We ordain that the present law, confirmed by the Seal of the State, be inserted in the "Collection of the Acts of the Government," commanding all whom it may concern to observe it and cause it to be observed as part of the Law of the State.

VICTOR EMANUEL.
(L.S.) GIACOMO DURANDO.

Turin, 30th day of March 1856.

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* Laureati.

Turin, March 30, 1856.

REPORT and ROYAL DECREE subjecting to certain modifications the Regulation dated June 5, 1854, upon Promotion in the Army

SIRE,

IN order to give effect to the law which it pleased Your Majesty to sanction respecting the manner in which in time of peace promotion to the rank of Lieutenant in the Infantry and Cavalry services is to be regulated, certain modifications having become necessary both in the Regulation on exemption from the law respecting promotion dated the 5th of June 1854, and in the subsequent law of the 4th of April 1855, the undersigned, in conformity with the said law, and after taking into consideration the opinion of the Permanent Consultative Congress on Affairs of War, has embodied in the annexed project of decree the above-mentioned modifications, developing with somewhat greater amplitude the guarantees required for promotion by selection to the grade in question.

In the case, therefore, of these dispositions meeting with the approval of Your Majesty, the undersigned prays Your Majesty to sanction them with Your Majesty's august signature.

Victor Emanuel II., King of Sardinia, &c., &c., &c.

Considering the laws of the 4th April 1855, and the 30th March 1856, on the proposition of the Minister, Secretary of State for the Affairs of War, We have ordained and ordain as follows :—

SOLE ARTICLE.

The tenor of §§ 81, 111, 112, 153, 183 of the Regulation of the 5th June 1854, must be understood and is conceived in the following terms :—

§ 81. Promotion to the rank,—

(*a*.) Of Lieutenant takes place among the Sub-lieutenants of the arm (law of 29th January 1854) four out of five times in order of seniority, and the fifth by selection (law of 30th March 1856), and occasions a series of five turns, of which the 1st, 2nd, 4th, and 5th have regard to seniority, and the 3rd to selection.

(*b*) Of Captain falls twice out of three times by seniority, and the third by selection among the Lieutenants of the arm (Article 16, law of the 13th November 1853), and occasions in each arm a series of three turns, of which the 1st and 3rd have regard to promotion by seniority, and the 2nd by selection.

(*c*) Of Major falls half by seniority and half by selection to the Captains of the arm in competition with those of the Staff Corps (Article 17 of the law of the 13th November 1853), there results accordingly a series of two turns, of which the first competes by seniority, and the second by selection.

§ 111. In case of their being Officers unattached immediately re-admissible to effective service, they are called upon to fill two-thirds of the vacancies which may occur in their rank and arm of the service (law of the 25th May 1852, Article 11).

§ 112. If, therefore, the question is of the rank of—

(*a*) Sub-lieutenant in the Infantry and Cavalry,

(*b*) Lieutenant in the Royal Carbineers,

(*c*) Captain in the Infantry, Cavalry, Artillery, Engineers, and Army Train, there results an extraordinary series of nine turns of which the 1st, 2nd, 4th, 5th, 7th, and 8th relate to the replacement of Officers unattached, and the 3rd, 6th, and 9th to promotion, corresponding to the 1st, 2nd, and 3rd of the ordinary series.

(*d*) Lieutenant in the Infantry, there is occasioned an extraordinary series of fifteen turns, of which the 1st, 2nd, 4th, 5th, 7th, 8th, 10th, 11th, 13th, 14th relate to the unattached list ; the 3rd, 6th, 9th, 12th, and 15th promotion, corresponding to the 1st, 2nd, 3rd, 4th, and 5th turns of the ordinary series.

§ 153. In the lists of propositions for promotion by selection are reckoned, as often as they satisfy the conditions indicated in § 147,—

(*a*) Non-commissioned Officers deserving of being promoted to the rank of Sub-lieutenant ;

(*b*) Sub-lieutenants, Lieutenants, and Captains who have acquitted themselves with singular distinction in the exercise of some special charge or function, or accomplished in

a commendable manner either missions or duties of an important and special or extraordinary nature; or who have signalized themselves by some extraordinary action, either of courage or otherwise meritorious; or have given evidence of a peculiar talent for and love of Military Studies, either in the courses of instruction established at the Royal Staff Corps or at the Military Institutions, or by special works performed by them; or finally, who may be distinguished among the rest by excellence of conduct, by their military behaviour, and by an ample store of technical knowledge and of that proper to the arm to which they belong.

§ 183. Hence promotion falls for the rank—

(*a*) Of Sub-lieutenant once out of three times by selection among the Non-commissioned Officers of the arm in which the vacancy occurs (law of the 4th April 1855), to whom, therefore, belongs the first turn of the series, the rules in §§ 79 and 80 of the Regulation being observed as far as regards the remaining two turns;

(*b*) Of Lieutenant for two turns out of three by seniority, and the third by selection among the Sub-lieutenants of the arm (law of the 4th April 1855), and occasions a series of three turns, of which the first and third relate to seniority and the second to selection.

The Minister, Secretary of State for the Affairs of War, is charged with the execution of this our decree, which will be registered in the general archives.

The following Tables contain the qualifications taken into consideration, with a view to the promotion of officers and men in the Sardinian Army,* and were communicated to us by the Hon. E. M. Erskine, Secretary of Her Majesty's Legation at Turin.

Battalion,_____ Company,_____

LIST of PROPOSITION of the SOLDIERS of the above-named COMPANIES who are considered deserving of the PREDICATE of "SELECT."

Number			Grade.	Surname, Name.	Category.	Date of Sanction.	Conduct.		Practical Military Instruction.	Remarks.
In the Ranks.	On the Roll.	On the Register.					On Duty.	Off Duty.		

The Captain commanding the Company.

* "Legge sull avanzamento nell' esercito. Regio Decreto del 5 Giugno 1854. Dall' Officina Tip^a e Lit^a di "Giuseppe Fodratti, No. 31, Via de' Conciatori."

Battalion,_____

List of Proposition of the Soldiers in the said Company who are

Number			Grade or Employment.	Surname, Name.	Category.	Date of Sanction.	Date of Nomination to the last Grade or Employment.
In the Ranks.	On the Roll.	On the Register.					

_____

Battalion,_____

List of Proposition of the Corporals of the above-named Company

Number			Grade or Employment.	Surname, Name.	Category.	Date of Sanction.	Date of Nomination to the last Grade or Employment.
In the Ranks.	On the Roll.	On the Register.					

Company,_____

considered deserving of being promoted to the Rank of CORPORAL.

Qualities.		Knowledge of the Subjects taught in the Regimental Schools.			Knowledge of the Subjects of Military Instruction.		If competent to perform the Duties of his Grade in every circumstance.	Remarks.
Physical.	Moral.	Reading.	Writing.	Arithmetic.	If competent to instruct Recruits.	The Subjects with which he is particularly acquainted.		

Company,_____

who are considered deserving of promotion to the Grade of SERJEANT.

Qualities.		Knowledge of the Subjects taught in the Regimental Schools.			If capaple of instructing Recruits and Squad.	If he has displayed the necessary firmness and dignity in the discharge of the Duties of his actual Grade or Employment.	Observations.
Physical.	Moral.	Reading.	Writing.	Arithmetic.			

Battalion,_____

List of Proposition of the Serjeants of the above-named

Number			Grade or Employment.	Surname and Name.	Category.	Date of Sanction.	Date of Nomination to the last Grade or Employment.	Qualities.	
In the Ranks.	On the Roll.	On the Register.						Physical.	Moral.

For the

List of Non-Commissioned Officers proposed for

Register Number.	Surname, Name, and Place of Birth.	If he has a Wife, or Children, and how many. —— Private Means.	Employment.	Years of			Date of Seniority in the Grade of Non-Commissioned Officer.	Corps.
				Age.	Service.	Present Rank.		

Company,_____

COMPANY who are considered deserving of being employed as ORDERLY.

Knowledge of the Subjects taught in the Regimental Schools.				Further Requisites.			Observations.
Reading.	Writing.	Arithmetic.	Caligraphy.	If theoretically and and practically familiar with Accounts.	If capable of instructing Recruits and commanding a Squad.	If he has displayed the necessary Firmness and Dignity in the Discharge of the Duties of his actual Grade.	

YEAR 18 ____.

Regiment.

advancement to the Grade of SUB-LIEUTENANT.

If from the Military College, a Volunteer, Conscript, or Substitute.	Total		Physical Qualities, Intelligence, Degree of Instruction, Courage, Conduct. — Opinion of the Commission, § 145 of the Regulation, 5th June 1854, on fitness for the superior Grade.	Observations		Remarks.
	Credit.	Debit.		Of the Officer commanding the Brigade.	Of the Inspector.	

For the

List of Proposition of Officers

Surname, Name, and Place of Birth.	If he has a Wife, Children, and how many. — Private Means.	Grade.	Date of Seniority in Grade.	Corps.

For the

List of Proposition of

Surname, Name, and Place of Birth.	If he has a Wife, Children, and how many. — Private Means.	Years			Campaigns.	Date of Seniority in the Grade.
		Of Age.	Of Service.	In the Grade.		

YEAR 18 .

Regiment.

for employment on SPECIAL SERVICES.

Special Employment for which the Candidate is proposed.	Remarks of the Officer commanding the Corps, with the Concurrence of the Field Officers, on the Fitness of the Candidate.	Observations of the	Remarks.

YEAR 18 .

Regiment.

for advancement to the Grade of .

Corps.	Whether from the Military Academy, the Military College, or from the Non-commissioned Officers.	Physical Qualities, Intelligence, Degree of Instruction, Courage, Conduct. Opinion of the Commission, § 145 of the Regulation, 5 June 1854, on Fitness for the Superior Grade.	Observations		Remarks.
			Of the Officer commanding the Brigade.	Of the Inspector.	

ADDISCOMBE.

ADDISCOMBE, &c.

We visited the East India Company's Military College at Addiscombe, which provides the whole of the Officers for their Artillery and Engineer Corps, and about one-sixth of those required for the Infantry service in India. Every facility was offered to us, and we received all the information we desired to obtain from the Lieutenant-Governor, Colonel Sir Frederick Abbott, K.C.B., and the Public Examiner, Major-General Sir Frederick Smith, R.E., K.C.B., who accompanied us.

Military College for Artillery, Engineers, and one-sixth of the Infantry.

We subsequently had to apply to the Secretary of the Military Department (Mr. Philip Melvill) for further statistical information, which was most readily supplied to us.

The College is under the government of the Political and Military Committee, who have power over the Public Examiner, the Lieutenant-Governor, the Visitor in the Oriental Department, and all the Professors, Lecturers, Masters, Assistants, and others on the establishment, as well as over the Cadets studying at the College; who also regulate and direct the expenditure requisite for the maintenance of the College, and the several details arising out of the rules and regulations, and issue such orders as circumstances may render necessary; subject always to the superior authority of the Court of Directors, and provided that nothing is done by the said Committee contrary to the established rules and regulations, without first receiving the Court's sanction thereto, as approved and confirmed by the Commissioners for the Affairs of India.

Government of the College by the Political and Military Committee.

A deputation of two or more members of the Political and Military Committee visit the College as often as they see fit, and they record their proceedings, if necessary, on the Minutes of the Committee.

The establishment for discipline and instruction consists of—

Establishment for Discipline and Instruction.

A Public Examiner and Inspector, and an Examiner in the Oriental Department.
A Lieutenant-Governor.
One Professor of Mathematics and Classics.
Five Assistant Professors, ditto, ditto.
One Master for the French language.
A Chaplain, being a Resident Professor who is in Holy Orders.
One Professor of Fortification and Artillery.
One Assistant Professor, ditto, ditto.
Two Professors of Military Drawing and Surveying.
One Professor of Hindustani.
One Assistant Professor, ditto.
Two Masters of Civil Drawing, including Photography.
Two Lecturers, Chemistry and Geology.
Lecturers as required in other branches of Natural Philosophy.

The Military branch consists of—

Military Staff.

One Staff Officer.
Two Orderly Officers.
An Instructor in Small Arms and Gymnastic Exercises.
Six Non-commissioned Officers, who also act as Clerks in the office of the Lieutenant-Governor of the College.
One Bugler.

To assist in maintaining discipline and in enforcing moral and gentlemanly conduct, Sub-officers are selected from among the senior Cadets by the Lieutenant-Governor, who also appoints Censors from each class to assist the Professors in maintaining good order during the hours of study.

Sub-Officers selected from the Cadets.

When any of the situations of Lecturer, Professor, Master, or Assistant Master become vacant, the several candidates for the appointment are examined by the Public Examiner, or the Visitor in the Oriental Department (if the

situation is in that department), and he reports on the qualifications of the candidates to the Political and Military Committee.

Annual Payment.

There is accommodation for 150 Cadets (each Cadet's bedroom being separated by a wooden screen from the others in the same room), and that number is now present at the College. Each pays a sum of 100*l.* per annum, and the additional expenses for uniform, clothing, books, and sundries, &c., makes the total expense to the parent somewhere about 125*l.* per annum, independent of the cost of travelling.

Appointment by nomination.

The appointment of Cadets is by nomination, and every candidate must produce a certificate of good conduct from the Master under whom he last studied.

Qualifications for Admission.

The qualifications for admission are, that the candidate must be able to write English well from dictation; to read and construe Cæsar's Commentaries; to shew an accurate knowledge of all the rules of Arithmetic usually taught in schools, viz., the Rule of Three, Compound Proportion, Practice, Interest, Vulgar and Decimal Fractions, and the Extraction of the Square Root.

Probationary Pupil for Six Months.

After admission every candidate is considered a probationary pupil for the first six months, at the end of which time the Public Examiner reports to the Committee on the probability of his being able to pass for the Artillery or Infantry at the public examination at the close of his fourth term of residence. Should this appear improbable, either from want of talent or diligence, the Cadet is then returned to his friends.

Age of Admission.

The age of admission is over fifteen and under eighteen years of age, and the average age of those admitted appears to be about seventeen and one-sixth. We were informed that about one-half of the candidates failed in passing this examination on their first trial, and that about one-third of the whole that came forward for examination were finally rejected.

Examination conducted by the Professors.

The examinations for admission are conducted by the Professors belonging to the establishment. They frequently take place from six to twelve months before the candidates are actually admitted.

Duration of Course.

The course of instruction in the College must be completed in four half-yearly terms, extending over a period of two years, unless the special permission of the Court of Directors be obtained for any Cadet to remain for a longer period; but, in order that Cadets may have the full advantage of any qualifications they may possess before they enter the College, it is not required of them to remain in it a longer time than one year, as they are eligible to be candidates for commissions in the Engineers at the first public examination that takes place after a year's residence, and, if found qualified, are appointed accordingly.

Studies.

The studies pursued, and the instruction given, are comprised under the following heads:—

1. Mathematics, including Natural Philosophy.
2. Fortification.
3. Artillery.
4. Military Drawing and Surveying.
5. Military Tactics.
6. Landscape Drawing and Photography.
7. Hindustani.
8. French.
9. Latin.
10. Religious Instruction.

Course in Mathematics.

The course of instruction in Mathematics embraces Algebra to the Binomial Theorem inclusive; the nature and construction of Logarithms; the Differential and Integral Calculus; the Geometry of Planes and Solids, and the application of Algebra to Geometrical Problems; Plane and Spherical Trigonometry, and the Analytical Investigation of Trigonometrical Formulæ; Analytical Geometry, including Conic Sections; Natural Philosophy, Statics, Dynamics. Hydrostatics, Hydrodynamics, and Astronomy.

The course in Fortification and Artillery includes the construction of plans; the modelling of the works of the masters, and the art of Attack and Defence of permanent and temporary fortifications; the nomenclature and description of different kinds of Artillery, &c.; the theory of projectiles; the use of field-pieces and mortars. Course in Fortification and Artillery.

The course of Military Drawing and Surveying comprises the operations of laying down a skeleton map trigonometrically, and filling in by aid of the compass; route surveying, reconnaissances, levelling with spirit levels and barometers; drawing with pen, pencil, and brush. Military Drawing and Surveying.

The course of Military Tactics, embraces the Manual and Platoon Exercise; the use of the broad and small Swords; Lectures on Strategy, &c. Military Tactics. Strategy.

The course of Landscape Drawing consists of the Elements of Perspective, Landscape, and Figure Drawing in pencil and brush, and Photography. Landscape Drawing.

The French course consists of the study of works in the French language on subjects of military science, and that of Latin in the study of selections from Latin authors. French and Latin.

Lectures are given in Geology, Chemistry, and Artillery. Geology, Chemistry, and Artillery.

The Cadets are divided into five classes, and are taught chiefly on the tutorial system.

The daily hours of study and the apportionment of time for each branch of study are shown in the two following tables for the summer and winter periods. In the summer it averages eight hours and twenty minutes, and in the winter seven hours and five minutes per diem. Daily routine.

Summer Studies at the Military College from March 15th to September 30th, inclusive.

Days and Classes.		7 to 8, A.M.	9 to 10. 55.	11. 5 to 1 P.M.	2 to 3. 45 P.M.	7. 30 to 9. 15 P.M.
Monday.	1	Mathematics	Mathematics	Fortification	Fortification	Latin.
	2		Mathematics	Hindustani	Hindustani	Library.
	3		Hindustani	Civil Drawing	Civil Drawing	Mathematics.
	4		Mathematics	Hindustani	Hindustani	Library.
	5		Mathematics	Military Drawing	Military Drawing	Latin.
Tuesday.	1	Mathematics	Mathematics	Military Drawing	Military Drawing	Library.
	2		Mathematics	Mathematics	Hindustani	French.
	3		Mathematics	Hindustani	Mathematics	Library.
	4		Mathematics	Fortification	Fortification	Latin.
	5		Fortification	Civil Drawing	Civil Drawing	Mathematics.
Wednesday.	1	Mathematics	Mathematics	Fortification	Fortification	Library.
	2		Civil Drawing	Civil Drawing	Civil Drawing	Latin.
	3		Mathematics	Military Drawing	Military Drawing	Latin.
	4		Mathematics	Fortification	French	Hindustani.
	5		Mathematics	Hindustani	Fortification	Fortification.
Thursday.	1	Mathematics	Mathematics	Mathematics	Hindustani	Library.
	2		Fortification	Fortification	Fortification	Mathematics.
	3		Mathematics	Hindustani	French	French.
	4		Mathematics	Civil Drawing	Civil Drawing	Library.
	5		Mathematics	Hindustani	Hindustani	Mathematics.
Friday.	1	Mathematics	Mathematics	Hindustani	Hindustani	Latin.
	2		Mathematics	Fortification	Fortification	Library.
	3		Mathematics	Fortification	Fortification	French.
	4		Mathematics	French	Military Drawing	Military Drawing.
	5		Mathematics	Mathematics	French	Library.
Saturday.	1	French	Civil Drawing	Civil Drawing	Civil Drawing	French.
	2	Mathematics	Mathematics	Military Drawing	Military Drawing	Library.
	3		Mathematics	Fortification	Fortification	Library.
	4		Mathematics	French	Hindustani	Hindustani.
	5		Mathematics	Hindustani	French	Library.

Military Surveying { *On Tuesdays*, Fourth Term (one-third of), from 9 A.M. to 3. 45. *On Wednesdays*, Third Term (ditto), from 9 to 10. 55, and *on Saturdays* from 9 to 3. 45. *On Thursdays*, Second Term (ditto), from 9 to 1. } Taken out of other Studies.

WINTER STUDIES at the MILITARY COLLEGE from October 1st to March 14th, inclusive.

Days and Classes.	7. 30 to 8. 30 A.M.	9. 20 to 11. 5.	11. 15 to 12. 50 P.M.	1. 45 to 3.	5. 30 to 7.
Monday. 1	Mathematics	Mathematics	Fortification	Fortification	Mathematics
2		Mathematics	Hindustani	Hindustani	Latin.
3		Civil Drawing	Civil Drawing	Civil Drawing	Mathematics.
4		Mathematics	Hindustani	Hindustani	Latin.
5		Mathematics	Mathematics	Military Drawing	Military Drawing.
Tuesday. 1	Mathematics	Mathematics	Military Drawing	Military Drawing	Military Surveying.
2		Mathematics	Mathematics	Hindustani	French.
3		Mathematics	Hindustani	Mathematics	Latin.
4		Mathematics	Fortification	Fortification	Mathematics.
5		Fortification	Civil Drawing	Civil Drawing	Mathematics.
Wednesday. 1	Mathematics	Mathematics	Fortification	Fortification	Fortification.
2		Civil Drawing	Civil Drawing	Civil Drawing	French.
3		Mathematics	Military Drawing	Military Drawing	Military Drawing.
4		Mathematics	Fortification	French	Hindustani.
5		Mathematics	Hindustani	Fortification	Fortification.
Thursday. 1	Mathematics	Mathematics	Mathematics	Hindustani	Latin.
2		Fortification	Fortification	Fortification	Mathematics.
3		Mathematics	Hindustani	French	Hindustani.
4		Mathematics	Civil Drawing	Civil Drawing	Hindustani.
5		Mathematics	Hindustani	Hindustani	Mathematics.
Friday. 1	Mathematics	Mathematics	Hindustani	Hindustani	French.
2		Mathematics	Fortification	Fortification	Mathematics.
3		Mathematics	Fortification	Fortification	Mathematics.
4		Mathematics	Military Drawing	Military Drawing	Mathematics.
5		Mathematics	French	French	Mathematics.
Saturday 1	Civil Drawing	Civil Drawing	Civil Drawing	Civil Drawing	Library.
2	Mathematics	Mathematics	Military Drawing	Military Drawing	French.
3		Mathematics	Fortification	Fortification	Fortification.
4		Mathematics	French	French	Hindustani.
5		Mathematics	Hindustani	Hindustani	Latin.

Military Surveying { *On Tuesdays*, Fourth Term (one-third of), from 9. 20 A.M. to 3. *On Wednesdays*, Third Term (ditto), from 9. 20 to 11. 5, and *on Saturdays* from 9. 20 to 3. *On Thursdays*, Second Term (ditto), from 9. 20 to 12. 50. } Taken out of other Studies.

Weight allowed to the various studies.

The relative value or influence allowed to the various branches of study is as follows :—

Mathematics, including Mechanics and Natural Philosophy	200
Fortification and Artillery	100
Military Surveying and Drawing	80
Civil Drawing and Photography	40
Hindustani	80
Latin	20
French	40
Chemistry	10

Half-yearly examinations conducted by the Professors.

The progress of the Cadets is tested by examinations at the end of each half year or term, which is usually of nineteen weeks' duration. These examinations are conducted by the Professors and Masters belonging to the establishment, and at the conclusion of each, a general list, arranged in order of merit, is made out showing the credits obtained by each of the Cadets. The Examination Papers in Mathematics are the same for the whole of the Cadets in the Institution.

Public examination twice a year.

A Public Examination in the presence of the members of the Court of Directors is held at the College twice in every year, viz., at Midsummer and Christmas, but it should be stated that this is nothing more than an exhibition, as the places of the Cadets are determined by the examinations conducted by Professors.

Public Examiner reports the names of those qualified for commissions.

The Public Examiner then reports to the Political and Military Committee the names of those Cadets who are qualified for Commissions in the Engineers, Artillery, and Infantry respectively, and Commissions are given to them according to the wants of the service in these several branches in the three Presidencies.

The tests of qualification in Mathematics for Commissions in the Infantry, Artillery, and Engineers are— Qualifications in Mathematics for the various services.

	Number of Marks allowed for these Subjects.
For the Infantry:—	Infantry.
Algebra, including Quadratic Equations, Surds, Progressions, Permutations, Greatest Common Measure, Least Common Multiple	280
Geometry, including the Properties of the Circle, Proportions of Plane Figures and Problems	300
Nature and use of Logarithmic Tables, Elementary Plane Trigonometry, and Heights and Distances, Mensuration of Planes and Solids	220
	800
For the Artillery, in addition to the preceding:—	Artillery.
Geometry, viz., Quadrature of the Circle, Planes and Solid Angles, application of Algebra to Geometry, Analytical Plane Trigonometry	180
Statics, including the Centre of Gravity and the Mechanical Powers, Dynamics, as far as the Motion of Projectiles	250
	1,230
For the Engineers, in addition to the preceding:—	Engineers.
Hydrostatics and Hydrodynamics	250
Theory of Curved Lines, including Conic Sections	180
Algebra, including Resolution of Numerical Equations, Expansion of Series	170
Differential and Integral Calculus to end of Maxima and Minima	170
	2,000

The remainder of the Differential and Integral Calculus and their application to Mechanics, together with Spherical Trigonometry, Geodesy, and Astronomy, are allowed to count for about 400 marks in addition to the preceding.

The course of Fortification and Artillery is taught from Major Straith's printed Treatise, Chapters 1 to 36 inclusive. The drawings to illustrate this course are sixteen in number. Qualifications in Fortification.

The Cadets for the Infantry are expected to finish at least eleven of these drawings, and those for the Artillery and Engineers are expected to complete the whole, in addition to drawings illustrative of the French modern system and the German system adopted for the fortresses of the Rhine, with additional details, relating not only to Permanent, but also to Field Fortification.

The Cadets attend lectures on Artillery, the Steam Engine, and the application of the Mechanical Powers to Machinery. They are instructed in sand modelling in a covered building erected for the purpose, and they also attend mortar practice.

There does not appear to be any specific rule as to the proportion of the maximum credits, which the candidates for the Engineers, Artillery, or Infantry must obtain to secure appointments in those services. It rests with the Senior Professor of Mathematics to determine whether a Cadet has a sufficient acquaintance with the subjects he has read, but a certain *number* of subjects for each branch of the Service must be read.

The selections for the various services are made according to general merit, the Cadet who has obtained the largest numerical credit being considered the best; and if any one high in "general merit" has not read the prescribed number of subjects, he is sometimes recommended or allowed three months to complete the Engineer course, and he comes before the examiners at the end of that time.

Such is now the pressure for the Engineer Service, that many Cadets are taken for that corps, who in the normal condition of the establishment would generally receive appointments in the Artillery; and again, as a consequence of

Engineer Cadets moved to the Establishment for Field Instruction at Chatham.

the above pressure, many are in consequence selected for the Artillery who would otherwise be appointed to the Infantry.

After passing the public examination, the Engineer Cadets are allowed some weeks of absence, after which they are sent to the Royal Engineer Establishment for Field Instruction, at Chatham, to be instructed in practical Military and *Civil Engineering*. The course of instruction generally lasts eighteen months. The Cadets whilst at Chatham are provisionally appointed Ensigns, and receive pay accordingly; they are provided with stationery and books from the East India Company.

Should they fail to complete their course within the prescribed period, they remain at Chatham without pay.

If any Cadet be recalled by the Court of Directors from under the command of the Director of the Royal Engineer Establishment, upon the Director's report of improper conduct or negligence of duty, he is not eligible to be promoted to a commission in the Engineer Corps, or even in the Artillery, if the Court shall deem the offence deserving of loss of appointment; and if he fails to qualify in his several studies within the time allowed for that purpose (unless the Director of the establishment shall certify that such failure was not occasioned by the neglect, inattention, or misconduct of the Cadet himself), he suffers such loss of rank amongst those Cadets who joined at the same time with himself as the Court shall determine.

Rank dependent on conduct and attention at Chatham, and also on their standing in the classified list arranged in order of merit.

Under this regulation, the Engineer Cadet's rank, according to his standing at the College, is held in reserve until the receipt of the final report of the Director of the Royal Engineer Establishment, upon the attention, diligence, and good conduct of each class of Cadets respectively.

Cadets selected for the Corps of Engineers rank with each other according to their standing at the College on the day when they pass their public examination, and, subject to the final decision of the Court of Directors on the Report of the Director of the Royal Engineer Establishment, they are commissioned as Officers in the Engineers in India from the same day, provided the ship on which they embark shall sail for India within three months from the date of their being reported qualified by the Director of the Royal Engineer Establishment, Should they not so proceed, they will rank below all Cadets of the same class with themselves who may be reported qualified before the date of their actual departure for India, unless they shall obtain leave from the Court of Directors to delay their departure; and this leave will only be granted on special grounds.

The Cadets appointed to the Artillery rank together in the order of their standing on the roll of general merit, and receive rank in the Artillery in India as Second Lieutenants from the day on which they pass their public examination, provided they embark for India within three months from that day; but if any Cadet shall delay his departure beyond that time without leave from the Court of Directors (which will not be granted except on special grounds) he will take rank only from the date of his embarcation for India.

Those Cadets who are appointed to the Infantry rank together in the order of their standing in the roll of general merit, and above all "direct" Infantry Cadets who have passed the Committee in the preceding three months, provided they embark for India within three months from the date of their passing their public examination; but if any Cadet shall not so embark, unless he has obtained leave from the Court of Directors to delay his departure (which leave will only be granted on special grounds) he will take rank only from the date of his embarcation.

Cadets of Engineers, Artillery, and Infantry are, to the extent which the wants of the sevice may permit, allowed the choice of Presidency in the order in which they stand in the roll of general merit.

Cadets who at public examinations are reported qualified for the Engineers or Artillery, but for whom there may be no vacancy in those branches of the service respectively, are presented with Honorary Certificates of their qualifications and meritorious conduct, are permitted to select the Presidency to which they shall be posted as Artillery or Infantry Officers, and their names are communicated by the Court for the observation of the Government in India, and for publication in General Orders to the army. Cadets who are not so reported, but who have attained proficiency in one or more branches of instruction, may be granted Certificates to that effect at the discretion of the Public Examiner.

The conditions of *direct* admission to the Company's Infantry and Cavalry

are as follows, it being understood that all candidates must receive a nomination from a patron:—

Conditions regarding Nomination.

The age of any candidate must not be less than sixteen years, nor exceed twenty-two years; unless he shall have been one year at least a Commissioned Officer in Her Majesty's service, or in the Militia, or Fencible Corps, when embodied, and has been called into actual service, or shall have been in the Company of Cadets of the Royal Regiment of Artillery; in which cases his age must not exceed twenty-five years.

Extent of Subject in which they are examined.

All candidates will be examined on the following points, before they are passed as Cadets:—

1. Each candidate will be required to write English correctly from dictation.
2. He should possess a competent knowledge of the ordinary Rules of Arithmetic, including the Rule of Three, Compound Proportion, Simple and Compound Interest, Vulgar and Decimal Fractions, and the Extraction of the Square Root. He should also have read the first three books of Euclid.
3. In Languages, he should be able to translate into English passages from Cæsar's Commentaries, or from the first four books of Virgil's Æneid, and he will be further expected to parse, and show his knowledge of Grammar and Syntax.

   The candidate will be required to translate from French into English an extract from one of the following works: viz., Telemachus, Voltaire's Charles the Twelfth, and Peter the Great. But the candidate will have the option of being examined in the Hindustani in lieu of the French language, and in that case he will be required to translate from Hindustani into English an extract from one of the following works: viz., Bagh-o-Buhar, Tota Kuhanee.
4. In History, he should be prepared to pass an examination in Keightley's Histories of Greece and Rome, in Gleig's History of England, and in the History of British India, contained in Vols. 1 and 2 of the Edinburgh Cabinet Library.
5. In Geography, he should possess a competent knowledge of the Modern Divisions of the World; the principal nations in Europe and Asia; the names of the Capital of each Nation in Europe, and of the chief Cities of Hindostan; and the names and situations of the principal Rivers and Mountains in the World.
6. In Fortification, he should have read some elementary work on the subject (Straith's Introductory Essay to the Study of Fortification, or Macaulay's Field Fortification), and have received some instruction in Drawing.

   By a resolution of the Court of Directors, passed on the 15th of January, 1852, it is stated "That the evidence to be required from candidates of their having acquired 'some knowledge of drawing,' is that they shall trace correctly upon paper, in presence of the Examiners, a front of fortification according to Vauban's first system, and also the profile of a Rampart and Parapet."

Board of Examiners meet every month.

The examination of the candidates will take place before a Board of Examiners, to be convened for that purpose at Addiscombe, near Croydon, on the first and third Tuesdays of every month during the term.

If not found qualified on their first examination, they may be allowed a second trial within the next ensuing six months; and if not then found qualified, their nominations will revert to their patrons.

Proportion entering the different services.

Of the seventy-five Cadets that annually leave Addiscombe for the East India Company's military service in India, about three-fifths join the Artillery and Engineers, and two-fifths are allotted to the Infantry.

We were unable to learn that the two-fifths of the Addiscombe Cadets who join the Infantry exercised any perceptible influence in raising the standard of qualifications in the general mass of the Officers of the Indian Infantry, who receive their appointments direct, after passing the examination which we have described, but without going through any Military College.

The Engineer Service is the great prize.

The great prizes at Addiscombe are the appointments to the Engineer service, which offer great pecuniary advantages over any other arm in India. For that service the Cadets will work very hard, and if they fail in obtaining it they gain the Artillery; but for those Cadets who evidently have no chance of obtaining admittance into either of these two Corps, there is little inducement to exert themselves, and, if we have been rightly informed, they do not do so.

Results of Final Examination.

Not more than two or three are annually removed for incapacity or want of attention.

Credits obtained.

The following table, showing the credits actually obtained by the Cadets who were examined for their Commissions in November 1855, as well as the credits they might have gained, appears entirely to confirm this statement, as the number of credits gained by the Cadets at the bottom of the list appears to be very small. It contrasts very unfavourably with the return of credits obtained

by the Students of the Polytechnic School in France, given in Appendix E. pp. 42–43; of those of the Students at the Engineers Academy at Znaim, in Austria, inserted at p. 174; and of the Cadets who left Woolwich Academy in 1851–2, given in Return D. p. 387.

EAST INDIA COMPANY'S MILITARY SEMINARY.

General Report of the Progress of the Gentlemen Cadets for the Month of November 1855.

	Rank of Cadet.	Credits obtained for the Studies in the various Studies; showing also the Maximum Number which might have been obtained.																General Merit.
		Mathematics.		Fortification.		Military Drawing.		Military Surveying.		Civil Drawing.		Hindustani.		French.		Latin.		
		Maximum.	Credits obtained.	Maximum.	Credits obtained.	Maximum.	Credits obtained.	Maximum.	Credits obtained.	Maximum.	Credits obtained.	Maximum.	Credits obtained.	Maximum.	Credits obtained.	Maximum.	Credits obtained.	Total obtained.
ENGINEERS.	1	183	150	114	86	*	26	40	40	*	30	88	80	*	38	20	15	465
	2	167	119		100		37		38		38	53	42		28		9	411
	3		100		78		30		38		29	88	77		36		16	404
	4		98		89		40		39		40		55		20		6	387
	5		95		75		27		31		28		70		35		8	369
	6		108		78		12		36		22		70		30		12	368
	7		92		63		34		33		36		65		23		16	362
	8		86		68		32		36		34		63		30		13	362
	9		96		61		14		34		23		79		36		17	360
	10		71		79		33		36		36		67		27		10	359
	11		95		61		25		37		33	53	50		27		11	339
	12	125	58		75		32		33		34	88	59		27		7	325
	13	167	73		72		25		28		31	53	41		36		9	315
	14		82		59		21		33		25		43		37		15	315
ARTILLERY.	15		111		71		26		38		26	36	18		19		4	313
	16	102	47		63		19		35		20	88	73		34		13	305
	17		47		87		32		36		38	35	20		40		2	302
	18		42		71		27		34		27	53	39		24		6	270
	19		50		53		27		28		20	88	61		20		11	270
	20		84		58		7		27		10	48	27		16		3	232
	21		35		43		9		21		18	88	71		28		7	232
	22		36		53		20		29		22	48	33		25		6	224
	23		29		40		14		23		10	88	57		22		16	211
	24	67	20		41		16		23		21		55		19		4	199
	25		34		37		13		26		19	53	38		19		9	195
	26		35		44		27		20		30	48	20		5		4	185
	27		25		47		23		24		23	35	14		24		—	185
	28		37		47		11		26		17	35	15		18		9	180
	29		24		48		26		21		22	47	20		15		4	180
	30		21		28		9		20		9		35		39		15	176
INFANTRY.	31		44		31		9		19		8	53	38		14		9	172
	32		28		43		18		17		24	35	16		18		8	172
	33		20		61		24		22		29	32	—		4		3	163
	34		29		22		7		14		13		6		20		9	120
	35		21		24		4		14		11		12		15		3	104
	36		15		15		15		11		17		—		24		3	100
	37		10		18		4		18		11		5		16		8	90
	38		15		19		5		10		13		6		4		2	74

Instruction in India for the Artillery.

The young Officers of the Artillery, on their arrival in India, are sent to Artillery Depots at the several Presidencies, where provision is made for giving them and the men of the Artillery who serve under them systematic instruction, in the practical duties of their profession, including a thorough knowledge of the use of Artillery apparatus of every description, as well as for enabling them to extend the theoretical knowledge they have already acquired in England.

and Engineers.

The young Officers of Engineers, on their arrival in India, are occupied for a short time in doing duty with the Sappers and Miners, for the purpose of improving their professional knowledge, and of acquiring the native language, before they are employed on detached duties.

It was in contemplation to establish a higher course of instruction for the Engineers in India, but the demand for officers has been so great as to prevent this intention from being carried into effect as far as their attendance is concerned;

* The maximum numbers that could have been obtained appear to be rather uncertain in these branches of study.

but the Institution, "The Thomason College," at Roorkee, has been established for the purpose of affording gratuitous instruction in Civil Engineering.

The sums annually expended by the Honourable the East India Company on Military Education are as follows :—

	Expense.	Number of Students.
The net expense of the Military College at Addiscombe, taken from the average of the last three years, is - - - - -	£5,771	150
The expense of training the Engineer Cadets at the Royal Engineer Establishment at Chatham last year - - - -	6,927	56*
The expense of training the Sappers and Miners, ditto, ditto -	2,600	106*
The expense of the Artillery Depôts in India, about - -	7,100	
The expense of the "Thomason College," at Roorkee† - -	9,000	
The expense of Officers at the School of Musketry at Hythe‡ -	700	
Total - -	£32,098§	

We append to our account, a letter received from the Public Examiner, Major-General Sir Frederic Smith, forwarding statements drawn up by the various Professors, explanatory of the system of instruction pursued in the Institution :—

Addiscombe Military College,
22nd May 1856.

GENTLEMEN,

I HAVE the honour to enclose for your information a copy of the Rules and Regulations for the good government of this institution, of which I have the honour to be the Public Examiner and Inspector.

You will perceive that candidates are only admitted between the ages of fifteen and eighteen, and the qualifications are specified in pages 5 and 6.

In page 7 the various studies pursued here are enumerated, and in page 12 the relative value allowed to the several subjects in forming the general merit rolls is represented by numbers.

In pages 13 and 14 the tests of qualification in mathematics, for Commissions in both the Scientific Corps as well as in the Infantry, are given in detail.

I enclose a statement drawn up by each Professor of the system of instruction in this particular branch, and showing the time devoted to it by each Cadet.

There shall be exhibited to you specimens of the drawings of the Cadets of the present term, and the examination papers of the Cadets of the last term, by which you will be enabled to judge of the degree of proficiency to which they attain in the period during which they are under instruction here, not exceeding in the four terms seventy-five weeks.

I have, &c.,

FREDERIC SMITH, *Major-General,*
Public Examiner and Inspector.

To the Commissioners appointed to report on various Systems of educating Officers for the Scientific Corps.

The Latin and Mathematical Studies.

Report from the Professor of Mathematics and Classics.

In the examination for admission into the East India Military College, the Cadets are required to write English correctly from dictation, to construe and parse Cæsar's Commentaries, and to be well acquainted with arithmetic.

Besides a perfect knowledge of Arithmetic, many of the Cadets have read Algebra, Geometry, and sometimes other branches of Mathematics, before

* Maximum number of students.

† Established for the purpose of affording gratuitous instruction in Civil Engineering, at which Commissioned Officers of Her Majesty's and the Company's Services receive instruction in Engineering, and classes of European Soldiers and others are kept up for the same purpose.

‡ A class of Officers on furlough from India is kept up here. They receive while studying here an allowance for house rent.

§ In addition to these sums, Engineer Officers at home on furlough are encouraged to improve their professional knowledge, and the entire expenses incurred by them on this account are reimbursed to them. The cost is very uncertain.

Report from the Professor of Mathematics and Classics.

they join the College; but whatever they may have read in schools,—which is often very imperfectly done,—they always commence with us at the beginning of Algebra, and go regularly through the course in the following order:—

Algebra, First Part.
Geometry, Sections 1, 2, 3, and 7.
Logarithms, Trigonometry, Heights, &c.
Mensuration.
Geometry, Sections 4, 5.
Analytical Geometry and Trigonometry.
Statics.
Dynamics.
Hydrostatics.
Conic Sections (analytically).
Theory of Equations.
Differential and Integral Calculus.
Spherical Trigonometry.
Astronomy.
Geodesy.

Before a Cadet passes from one subject to another he is always examined by the Professor in the class above (except, of course, in the first class). This we conceive to be of the utmost importance, and prevents the Cadets from pressing forward in a careless and imperfect state of knowledge.

Besides this check, there are examinations at the end of each term in which the Cadets are examined in *all* the subjects, beginning with Arithmetic and proceeding as far as they have read. They are all examined from the same papers; this ensures attention to the lower subjects.

The minimum course for the Infantry extends to the end of Mensuration.

The minimum course for the Artillery extends to the end of Projectiles.

And the minimum Engineer course extends to the end of Maxima and Minima in the Differential Calculus.

Each of the five classes is engaged from eighteen to twenty hours a week in the study of Mathematics. They remain at Addiscombe generally four terms, or two years; and the duration of each term is about nineteen weeks.

JOHN CAPE,
Professor of Mathematics and Classics.

Fortification Course at Addiscombe.

Report from the Professor of Fortification.

After learning the use of their scales, &c., and the necessary elementary geometrical problems, the Cadets in their first term are expected to make themselves thoroughly acquainted with the very full definitions contained in chapter 1st of Straith's "Treatise on Fortification and Artillery," which is the work on those subjects used here by authority. During several studies, they are subsequently employed in the sand-modelling hall, where they are made practically acquainted with the form and construction of field-works in general, by throwing them up *with their own hands* in moistened sand to a given scale. This part of their course (occupying about six studies), is usually concluded by the construction of a front of Vauban's first system. The Cadets are thus, early in their first term, made acquainted with the actual forms and dimensions of works which they are expected soon to draw; and as a matter of course, they can comprehend more readily and realize more accurately the nature of the works they now begin to represent on paper.

The plans of the course are sixteen in number, the whole of which must be completed *in* study by all candidates for the Engineers and Artillery appointments. The minimum course required from the Infantry comprises the first nine and the two last of the course, which is as follows:—

1. Profiles of field-works.
2. Lines at intervals.
3. Bridge heads.
4. Plan profile and elevation of a rampart, &c.
5. Square redoubt.
6. Mining cases and field powder magazines.
7. Field batteries.

Report from the Professor of Fortification.

8. Ramparts, staircases, &c.
9. Vauban's first system, with profiles.
10. Profiles of the modern system.
11. Countermines.
12. The modern system.
13. Saps, single and double.
14. The Prussian system, with sections.
15. Profiles to the attack.
16. The attack of Vauban's first system.

The above course can easily be completed with common application, and is much exceeded by diligent Cadets, who are subsequently employed in executing plans and elevations of the systems of Carnot, Boussmard, Dufour, Cohorn, and other writers on Fortification, or, in some cases, of locomotive and stationary steam-engines.

The theory course comprises twenty-four chapters of the treatise, of which *two* are expected to be acquired in each of the first three months of the term of four months. The six chapters are revised for the final examination in the last month. Certain studies in each class are set apart for becoming acquainted with the subject matter of each chapter, to enable the Cadets to undergo a written examination at the close of each of the first three months in that portion of the treatise which they have previously read for the purpose; when answers are given to questions dictated by the Professor, who afterwards takes them home, to enable him the more carefully to examine and reward them by marks according to the merit of each reply; these, being added up, are placed to the credit of the Cadets who gave them.

At the close of each term, that is in the *fourth* month, a general examination of *all* the Cadets takes place. Four printed papers, each consisting of fifteen questions, are prepared, to be answered in writing in five hours and twenty minutes. The first paper is given to all the Cadets to be answered in the time allowed, viz., one hour and twenty minutes. The second paper is given to the *three* senior Terms; the third is given to the *two* senior Terms; the *fourth* to the senior Term only; the same time being allowed to answer the questions in each of the four papers. The answers to these questions are also taken home by the Professors, who carefully compare and examine them, and reward them by marks according to merit.

The marks thus obtained in the final or general examination, added to those of the monthly examinations, determine the place of each Cadet at the end of the term, as far as theoretical knowledge is concerned. It should, however, be observed, that the questions in the monthly as well as in the general examination are arranged, so as to test not only the theoretical information of the Cadets, but also their ability in *plan drawing*, as they are required to draw during the examination plans and sections of various kinds by scale and from memory.

The plates drawn in each term are likewise compared one with another, and a number given to them respectively in proportion to their merit. The aggregate number for plates being added to that obtained for theory, fixes the proper position of each Cadet in Fortification.

In passing through the third class the Cadets attend a course of twelve lectures on Artillery, delivered by the junior Professor; and the Cadets of the second class attend a course of lectures on the Steam Engine (locomotive and stationary), given by the senior Professor, who also delivers lectures on the simple mechanical powers, on the models of different systems of Fortification, on the attack of Vauban's first system, &c. This class was, until the water left us, practised in throwing bridges of different kinds across a piece of water called the Cold Stream. The first or senior class is taken out during some part of each term to practise throwing shells with small charges from two eight-inch and a ten-inch mortar, the range being about 700 yards. Hand grenades are occasionally thrown in practice. The two senior classes, moreover, are practised in squads, in constructing batteries and saps to a scale, with gabions and fascines, and in the art of defending field-works, in a large box or case six feet square, containing moistened sand, *in* the fortification hall or study, under the eye of the Professor, while the majority of the class are employed in plan drawing; and about the middle of each term several squads from the *senior* class are sent out to the sand-modelling hall to trace the various works which

Report from the Professor of Fortification.

are afterwards constructed by men employed in this department, to be explained by the Cadets about to leave, on the final day of each term to the Court of Directors and assembled company of visitors. In conclusion, it should be stated that all the classes are at the commencement of each term taken into the sand-modelling hall for the purpose of hearing a lecture from their Professor, in explanation of the various sand models constructed at the close of the previous term, that they may obtain as much information as possible from them before they are broken up to make way for others of a more simple character, to be executed by the hands of the Cadets who have entered upon their first term, as above adverted to.

THOS. COOK, Lieut., R.N.,
Senior Professor of Fortification at Addiscombe.

P.S.—I have omitted to state the time devoted to the study of Fortification at Addiscombe.

The *two* senior classes have *together* eighteen hours, and the *three* junior classes have twenty hours each week, equal to thirty-eight hours a week devoted to this branch of study; equal to 722 hours in each term of nineteen weeks; equal to an average of about 144½ hours to each class per term, or 578 hours during the four terms of residence.

GENTLEMEN, *Addiscombe, September* 5, 1856.

Proposed new mode of teaching Military Surveying.

PERMIT me to avail myself of the opportunity afforded me by your recent official visit to this College, to submit for your favourable consideration an idea of mine, which, if acted upon, would, I feel very confident, prove highly beneficial to military establishments in general. My suggestion has reference to Military Surveying, and is as follows.

Let the Cadets have the opportunity of becoming practically acquainted with this important branch of their profession by having a field of convenient dimensions (say 150 yards square) appropriated to their use adjacent to the College, in which let there be thrown up (what may be termed) miniature hills of every variety of shape and conformation, such as would prove the most suitable for the object in view. If the scale of *one* inch to a foot be adopted, such a piece of ground would represent a space of rather more than a mile square. Let this be subdivided into four parts, each representing half a mile square; the subdivisions being made to differ very materially in their features. Let white posts or pickets be driven into the ground on the summit of the hills, upon which the name or number of the hills may be marked, and upon which a pocket compass may be placed while the bearings of the posts upon the adjacent hills are being taken. Let four small squads of Cadets, furnished with such compasses, be sent to survey these sub-divisions of ground; each squad having completed the survey of the four parts, might be permitted to survey the whole ground; the distances and the heights being multiplied by twelve, would produce the same results as if the survey had been taken of a square mile of natural ground.

That such practice in miniature would prove an admirable *auxiliary*, and would prepare the Cadets for more rapidly benefitting from an actual survey, cannot for a moment be doubted. Much time would be saved which is now lost in going to and returning from the surveying ground. The surveys would be more quickly made, and by *all* the Cadets, as from being broken up into small squads, all must take part in the work, whereas when taken in large parties the actual work is usually done by a few, who are the most anxious to become acquainted with the subject. Moreover, the Professor having once made a correct survey of each sub-division, as well as of the whole, would at all times be able to test the faithfulness of the production of the different squads at a glance, and point out the error, if any, without necessarily confining his attention to any squad in particular, as the bearings and the distances of the parts would always remain the same, while the surveyors would ever be changing. The object could be attained at a very small expense. A few railway excavators would very soon throw up the hills. The ground would be just as valuable for grazing on.

I can speak with more confidence than would otherwise become me, from having already partially carried out in practice the idea here suggested; for, by the permission of the Lieut.-Governor, I had miniature hills thrown up in a field

Report from the Professor of Fortification.

work (since destroyed to build upon) which were surveyed, and which fully realized my expectations; and, moreover, my opinion is further confirmed by about 16 years' experience of the vast benefit arising from the adoption of a similar substitute, for conveying a knowledge of the art of fortification to Cadets through the instrumentality of sand models.

I have, &c.

THOMAS COOK, *Lieut. R.N.*
Senior Professor of Fortification, Addiscombe.

To the Commissioners appointed to report on various Systems of educating Officers for the Scientific Corps.

Report from the Professor of Military Drawing.

STATEMENT of the COURSE of INSTRUCTION in MILITARY DRAWING at the EAST INDIA COMPANY'S MILITARY COLLEGE, ADDISCOMBE.

First Term.

1. Printing letters, from copies, in the Roman and Italian characters - - - - - - *vide* Nos. 1 and 2
2. Shading with a brush, in Indian ink, Geometrical Planes and Solids - - - - - - „ 3, 4 and 5
3. Ditto, applications of ditto to hill forms - - 6 and 7

Second Term.

1. Copying first essays of ground in pencil etching - „ 8
2. Ditto second essays, being hill delineations in pencil contouring - - - - - - „ 9 and 10
3. Ditto plans of hill ground, in shading - - - „ 11
4. Reducing ditto to contouring in pencil - - - „ 12

Third Term.

Drawing from Models of Ground.

1. Sketching and contouring them, in pencil - „ 13
2. Shading them, on the first principles of the Geometrical Solids - - - - - - „ 14

Fourth Term.

Copying plans of ground, comprising a variety of subjects in Military Drawing, finished in pencil, pen, or shading and colouring; the most difficult subjects being those of plain and contoured outlined maps, or plans of surveys, to be transferred into finished plans, shaded and coloured - - - - - „ 15

WM. A. TATE,
Professor of Military Drawing.

Hours of Study.

First class.	Fourth term - - -	$3\frac{1}{2}$ hours every week.
Second class.	Part of fourth and third term	$3\frac{1}{2}$ „
Third class.	Part of third and second term	$3\frac{1}{2}$ „
Fourth class.	Part of second and first term	$3\frac{1}{2}$ „
Fifth class.	First term - - - -	$3\frac{1}{2}$ „

From the first and second classes a squad is taken out for Military Surveying alternately every three weeks.

Report from the Professor of Military Surveying.

MEMORANDUM showing the SYSTEM of INSTRUCTION in MILITARY SURVEYING at ADDISCOMBE.

1. Instruction is afforded for all the Cadets.
2. They begin surveying on entering on their *second* term, and remain under instruction to the end of their stay at the College.

Report from the Professor of Military Surveying.

3. The number of Cadets under instruction belonging to the three senior terms averages 112, and they are formed into *nine* squads of twelve or thirteen in each.

4. A squad from each term is employed every week; viz.—

Tuesday, one of 4th Term, from 9 till 3.30.
Thursday ,, 2nd ,, from 9 till 1.
Saturday ,, 3rd ,, from 9 till 3.30.

Also two hours are allowed every Wednesday to a squad of the third term for *plotting*.

The course of instruction pursued may be best understood by following a squad through its prescribed work:—

1. It is out once in every three weeks.
2. The squad is instructed in taking bearings with a prismatic compass, and some explanation of the instrument is given. The squad is then sub-divided, and the two parties separate and take bearings along a couple miles of road, measuring the distances from point to point by the marching paces of thirty inches. In this manner a round is made, closing on the starting point.
3. The road is plotted to scale with the ivory protractor, when it is seen how much each Cadet is out in his work.
4. The next step is to teach the use of the spirit-level, and explain the principle of levelling; then the practice of levelling for difference of level. Also, a section is made of a field-work with a spirit-level.
5. A convenient portion of hilly ground, of limited extent, is triangulated, by measuring a base with the chain and the angles with a theodolite. The same work is then laid down on a large scale with a brass protractor.

[Each squad is engaged for four hours every *third* week throughout the term.]

1. In its third term, the squad is taught to collimate, and otherwise to adjust a theodolite.
2. A road which encompasses the space comprised within the limits of the ground already triangulated is carefully *traversed* with the theodolite and chain; the squad working in sub-divisions.

[Each squad of the third term is occupied during $7\frac{1}{2}$ hours in every *third* week.]

1. In its fourth term the squad transfers the chief points from the survey in hand to *sketching blocks*, upon which the hilly ground is then very carefully sketched, to be afterwards transfered to the *plan*.
2. The Cadets are exercised at different times in using the pocket-sextant for determining the breadth of a river, heights of buildings, laying out field-works, &c.
3. All the squads of the term are employed one evening in the week, during the winter months, in reading the greater portion of Lieutenant-Colonel Jackson's Treatise on Military Surveying, upon which they have three separate examinations.

[Each squad of the fourth term is employed during $5\frac{1}{2}$ hours every *third week* in the field, and $1\frac{1}{2}$ hours per week in reading and undergoing examinations during the *winter hours*.

(Signed) Basil Jackson, Lieut.-Colonel,
Professor of Military Surveying.

Addiscombe, May 19, 1856.

CIVIL DRAWING DEPARTMENT AT ADDISCOMBE MILITARY COLLEGE.

Reports from the Professors of Civil Drawing.

Two Professors.

Classes.	—	Hours of Study.	—
1st, 2nd	Senior Professor.	Five hours and a half each Class.	One day in the week to each Class.
3rd, 4th, 5th	Junior Professor.	Three hours and a half each Class.	One day in the week to each Class.

Each Gentleman Cadet is furnished with two books:—

Penley's Elements of Perspective; and
A System of Painting in Water Colours.

Course of Study.

The Elements of Perspective.
Pencil Drawing in Outline and Shading.
Tinted Drawing.
Water Colours from the first washing to the finished Picture.

A freedom of the pencil having been acquired, together with the use of the colours and a power of manipulation during three terms, a course of lectures on the science of the art is delivered to the senior term by their Professor, illustrated by diagrams, and arranged under the following heads:—

Principles.
- Form.
- Perspective.
- Imitation.
- Invention.
- Composition.
- Light and Shadow.
- Colour.

These lectures are instituted for the purpose of enabling Officers to work out their own sketches on sound principles, as well as to form a correct judgment upon pictorial art in general.

The Senior Cadets are also instructed in Photography when the weather will permit.

AARON PENLEY.

SIR, *Addiscombe, May* 20, 1856.

Report from the Professor of Hindustani.

ACCORDING to the instructions received from you on the 13th of this month, I have drawn up the following statement respecting the Hindustani department at this College, from which I trust you will be able to comprehend the mode of carrying it on, and also to form an opinion on its results:—

1. The students at Addiscombe usually number about 150, and they are divided (1) into four terms, and (2) into five classes of thirty each.
2. The first, second, and third classes are under the charge of the Professor, and the fourth and fifth classes are attended by the Assistant Professor.
3. The time allotted to the study of Hindustani is, on an average, about thirty hours twelve minutes per week.
4. The highest number awarded to proficiency in this branch of study is 80.
5. At the end of each half-year four prizes are distributed, namely, two to the first two students of the fourth term, and one to each of the first on the lists of the third and second terms.
6. A report is made out at the end of each month, in which the progress of every student is specified under one or other of the following heads:—Great, Satisfactory, Moderate, and Little or none.
7. The class-books in use at Addiscombe for this study are (1) Shakespear's Grammar, (2) Shakespear's Dictionary, and (3) Shakespear's Selections, in two vols., which comprise extracts from several of the best known and most useful works in the language.

8. The Hindustani language is commonly written in two characters, namely, the Persian and Nāgarī; of the former about ninety pages, and of the latter about sixty pages, form the course of reading at Addiscombe; and when this is finished, the students proceed to translate English exercises into Hindustani, and write them, alternately, in the characters mentioned above.
9. At the end of each half-year the students are subjected to a written examination by means of printed papers, of which *three* are issued; first, a grammatical paper, containing about sixty questions, to answer which a knowledge of the most useful principles of Hindustani grammar is necessary; second, a paper for translation into English, consisting (1) of six extracts of about six or seven lines each, from the reading in the Persian character, and (2) of four extracts of a like extent from the Nāgarī text; and third, a paper of about ten or twelve lines of English to be translated into Hindustani, and written in the Persian and Nāgarī characters.
10. The total of unreduced marks awarded to these papers is 1800; namely, 600 to each.
11. The time allowed the students to answer the above papers is about three hours for the first and second, and somewhat more to the third, and when so engaged they are not allowed the use of any books, but must depend entirely on their own resources.
12. Besides the examination already mentioned the Cadets of the fourth term, and such of the other terms as may be candidates for prizes, have to attend the examination of the Oriental Visitor, who requires them to read and translate to him any portion that he may think proper of whatever they may have read during their residence at Addiscombe. An English exercise is translated into Hindustani, and written in the two characters in the presence of the Oriental Visitor.
13. In order to enable you, Sir, to form an opinion on the system described, I have thought it best to lay before you, so far as the fourth term is concerned, a statement of the last two years' results; stating, first, the number of Cadets who obtained a certain average number; second, what that average number is; and third, their report for progress:—

Number of Cadets.	Average number out of 80.	Report for progress.
	May 1854.	
15	61½	Great.
14	18	Moderate.
8	4	Little or none.
	November 1854.	
3	79	Great.
12	51	Satisfactory.
12	15½	Moderate.
9	4¼	Little.
	May 1855.	
15	67½	Great.
11	37	Satisfactory.
5	11½	Moderate.
6	1½	Little.
	November 1855.	
14	67½	Great.
11	40	Satisfactory.
8	16¾	Moderate.
5	4½	Little.

I have, &c.

(Signed) C. Bowles.

Major-General Sir F. Smith, K.H.,
Public Examiner and Inspector,
&c. &c.

ROYAL MILITARY ACADEMY, WOOLWICH.

ROYAL MILITARY ACADEMY, WOOLWICH.

Origin of the Academy.

Before proceeding to give an account of the system of studies, discipline, and economy at present in force at the Royal Military Academy it may be as well to premise a few particulars respecting its origin.

Warrant of Geo. II.

Although it is alleged that an institution similar in nature, but on a much more contracted scale had previously existed in the neighbourhood, no official notice of such a school remains to us earlier than the warrant of George the Second, constituting an Academy on Woolwich Warren, and bearing date the 30th of April 1741. The room selected for the school formed part of a building appropriated to the use of the Board of Ordnance when at Woolwich; it was built in 1719 on the site of a house once occupied by Prince Rupert, and is now, or was until lately, a part of the Royal Laboratory.

Subjects of the Instruction given.

The object of the institution was stated in the first "Rules and Orders for the Academy" to be the teaching, "both in theory and practice, of whatever might be necessary and useful to form good Officers of Artillery and perfect Engineers;" but its benefits were not to be confined to Officers, for it was ordered that the lectures should be attended by the "Practitioner Engineers, Officers, Sergeants, Corporals, and Cadets of the Royal Regiment of Artillery not upon duty," and also by all such Privates of the two Corps as might have "a capacity and inclination to the same."

In 1764 the Officers, Non-commissioned Officers, and Privates ceased to participate in the instruction given at the institution; but after the Academy had been twenty-five years in existence we find a class of students under the title of Gentlemen Attendants, distinguished from the Cadets, by the payment of an entrance fee of thirty guineas, subsequently divided, according to a scale fixed by an order of the Master-General of the year 1778, between the Inspector, Professors, and Masters.

Viscount Townshend, who was at this time Master-General, appears to have introduced the practice of appointing extra Cadets, admitted gratuitously, and subsequently placed on the list of the Company as vacancies occurred.

Both these classes of students, however, the extra Cadets and Gentlemen Attendants, were, in 1778, by order of the same Master-General, prohibited from occupying quarters in the barracks allotted to the Cadets.

Cadets originally attached to the Regiment of Artillery.

The Cadets were originally attached to the Royal Regiment of Artillery, five to each Company, of which there were seven, but it does not appear that they at once reached the number of thirty-five; in 1744 there were about twenty.

Cadet Company formed, 1744.

In that year they were formed into a Company by themselves, the maximum of their numbers being fixed at forty. Previously to the establishment of the Cadet Company, the Cadets, who were usually the sons of Officers residing at Woolwich, wore no uniform and were subject to no command, the masters finding the greatest difficulty in enforcing any kind of discipline.

Gradual augmentation of their numbers.

In 1746 the maximum was raised to forty-eight, and, again, in the year 1782 to sixty, in consequence of the Regiment of Artillery being augmented from one to five battalions, and the Corps of Engineers from twenty-nine to seventy-five Officers. Thirty Cadets were added in the year 1793, which raised their number to ninety. In 1797 the admission of the Gentlemen Attendants was discontinued, and private lessons, which had hitherto been given by the Professors to the Cadets after the hours of study, were forbidden

East India Company's Cadets, 1798.

The Company of Cadets was augmented in 1798 from ninety to a hundred for the purpose of extending to the East India Company's Service the benefits of the education given at the Academy. The ten additional Cadets were appointed on the recommendation of the Court of Directors, who were to nominate to two vacancies out of every five that might occur (exclusive of those among their own Cadets) until they had forty in the institution.

The establishment of the academy thus consisted of sixty King's Cadets and forty of the East India Company's; but as this number was considered likely to be inadequate, especially in time of war, additional or extra Cadets were appointed, who were placed at schools in the neighbourhood, and transferred to the Academy as vacancies occurred, the proprietors of such schools being allowed 2*s.* a day for each Cadet so educated, and after the year 1800, 2*s.* 6*d.*

Numbers of the Cadets, &c.

History of the Academy.

The East India Company paid at the rate of 100*l.* per annum for each of their Cadets at Woolwich, and 2*s.* 6*d.* per diem for each at the preparatory schools, as well as the sum of 3,000*l.* in the first instance for the expenses at Woolwich incidental to the arrangement. An arrangement was made in the year 1803 with the Governor of the Royal Military College at Great Marlow, that the extra Cadets who were waiting for vacancies at Woolwich should be educated there instead of at private schools, as during the preceding five years.

In 1806 increased accommodation was provided for the Academy on another site, and 128 Cadets occupied the new building on Woolwich Common. It contained 30 bedrooms: 4 Cadets sleeping in a room. Additional accommodation, however, has since been provided in the towers for about 20 more. Part of the old Cadet Barracks on the Green in the Arsenal were fitted up for a lower establishment, which was opened for sixty Cadets. The rooms for study were formed out of the old hospital; two rooms for thirty each. The entire establishment now consisted of 128 at the upper establishment on the Common, sixty at the lower establishment in the Arsenal, and sixty at Marlow; 248 in all. In the year 1810 the East India Cadets were withdrawn, and, in consequence, no more Cadets were sent to Marlow. Those, however, of the East India Company's Cadets who were intended for the Engineers received instruction at Woolwich in the Trigonometry Survey as late as 1821, when arrangements were made for completing this part of their education at Addiscombe.

A statement of the average number of Cadets at the Academy between the years 1820 and 1855 will be found in Table B., appended to Major-General Lewis's evidence. In the year 1840, their increased number rendering the accommodation on the Common insufficient, the Cadet Barracks in the Arsenal, which, since 1806, when they were first closed, had been occupied and relinquished by the Students from time to time, according to the wants of the Service, were again opened for the Practical Class. They remained occupied in this manner until last year, when, in consequence of the transfer of the Head Quarters of the Engineers to Chatham, the Sapper Barracks, at no great distance from the Arsenal, becoming vacant, it was thought more convenient to remove the Practical Class thither, leaving the Arsenal entirely at the disposition of the Departments immediately in connexion with it.

Proportion of vacancies in the Corps to the number of Cadets qualified.

Between the years 1822 and 1825 there appears to have been a considerable overplus in the number of Cadets qualified for commissions as compared with that of the vacancies proposed to be filled up in the two Corps, and during those years permission was given by the Master-General of the Ordnance to a certain number so circumstanced to visit the fortresses in the Netherlands.*

A similar reason, as early as the year 1798, was the cause of a limited number of Cadets, who were ultimately intended for the Corps of Royal Engineers, being sent, with the pay and allowances of an Officer, as Assistant Engineers to some Station, until they could be commissioned in the Corps for which they were destined.

Commissions in the Line granted to Cadets.

In 1825, when the number waiting for Commissions was at its highest, the Commander-in-Chief distributed among the Cadets at Woolwich a considerable number of Commissions in the Line. We are unable to find a record of more than forty-five so given; but it is said that the amount, at least of those given about this time, was considerably greater.

In all circumstances in which Cadets, who were qualified for Commissions, were waiting to obtain them, they continued to receive Cadet's pay (viz., 2*s.* a day and 6*d.* for clothing), except in the case of their refusing the offer of a Commission in the Line, when their pay was stopped.

Since that time the numbers at the Royal Military Academy, and the filling up of the vacancies in the two Corps, have been kept in stricter proportion to each other.

A table of the vacancies in the Corps, compared with the number of Commissions given each year during a period of eleven years, is appended to this account of the Academy. (*See* Annex 1.)

Until the late war, Commissions in the Royal Artillery or Engineers were very rarely given to others than those who had received their education at the Royal Military Academy; many of the exceptions which are met with during

* The following were the exact numbers of those who received this permission :—

In 1822	37	In 1824	55
1823	47	1825	66

the first years of its existence being found to consist of gentlemen who, though not, strictly speaking, Cadets, had nevertheless enjoyed the advantages of its instructional system.

Provisional Commissions in the Artillery thrown open to competition.

In 1855 the pressure occasioned by the war induced the Secretary of State for War to throw open a limited number of direct Appointments in the Artillery to public competition. The successful Candidates received Provisional Commissions in the Artillery, and were placed in charge of the Director of Artillery studies, with a view to their acquiring the necessary professional knowledge. This Officer sent in a monthly statement of their progress, and, on his reporting that they were sufficiently advanced, their Commissions were confirmed.

The numbers to whom Provisional Commissions have been given are as follows:—

August 1855 - - -	18
January 1856 - - -	17
July 1856 - - - -	12
	47

Regulations of 1848.

In consequence of certain irregularities and offences against discipline which became known to exist in the Academy, a Committee, under the presidency of Sir Thomas Hastings, was assembled in 1846, and continued sitting until 1848. The report furnished by them was the cause of several modifications being introduced into the system of discipline and study. Amongst others, Divine Service was performed separately for the Cadets, who had hitherto attended the chapel allotted to the garrison; and the duties of the Chaplain, whose office was originally created in 1806, but had fallen into abeyance, were defined. In addition to the performance of Divine Service twice on Sundays and holydays, and the reading of prayers every morning and evening, he was charged with the functions of Honorary Librarian, and had to conduct the Entrance Examination of the Cadets in Latin: to ascertain, at the same time, the sufficiency of the religious instruction which they had received, and to continue such instruction while they remained at the Academy.

It was on the report of this Committee that the regulations of 1848, still for the most part in force, were based.

Staff of the Academy.

The original Staff of the Academy consisted of a Chief Master with a salary of 200*l.* per annum, and a Second Master at 100*l.* per annum. Both of these officials gave lectures in the theory for three hours each on the same three days of every week, while the remaining three days were devoted to practical instruction. The last-named exercises commenced at 6 A.M. in summer, and 8 A.M. in winter, and were continued four hours daily.

Officers of the Cadet Company.

To the Cadet Company there were attached one Captain-Lieutenant, one Lieutenant, one Lieutenant Fireworker, and one Drum Major (1744).

Lieutenant-Governor, 1764.

In 1764 the Institution underwent considerable modifications. At the same time that the instruction was, as above stated, confined to the Cadets and Gentlemen Attendants, a Lieutenant-Governor was appointed, by whom, and not as heretofore by the Commanding Officer at Woolwich, all orders were issued; and the reports on the progress of the studies, hitherto sent in every month by the Chief Master directly to the Master-General of the Ordnance were now, as well as those on the state of military discipline, addressed to the Lieutenant-Governor, the latter Officer becoming responsible for the working of the whole Institution which then assumed the title of the "Royal Military Academy."

Professor of Fortification, &c. Professor of Mathematics.

The Chief Master was then styled "Professor of Fortification and Artillery;" the Second Master "Professor of Mathematics;" and an additional Master was appointed to teach Classics, Writing, and common Arithmetic at a salary of 100*l.* per annum.

Inspector, 1772.

In 1772 the office of Inspector of the Royal Military Academy was created; a class list of all the students under their respective care was to be furnished monthly by each of the Professors to this Officer, who, in his turn, was to make a monthly report to the Lieutenant-Governor of the state of information and progress of studies in the Upper and Lower Academies, two sections into which the Institution had already for some time been divided.

A French Master and a Modeller had, as early as 1743, been added to the Establishment; in the succeeding year a Drawing Master, and in 1759 a Fencing

Educational Staff.

Master had been appointed, and a second Mathematical Master, French Master, Fortification Master, Drawing Master, and Modeller had been subsequently added, so that in 1798 when the graduated table of extra allowances to the body of instructors consequent on the suppression in the previous year of the Gentlemen Attendants and of the private lessons to Cadets, two important items in their emoluments, the civil establishment appears as follows:—

—	Greatest Number of Times of Attendance in One Year.	Allowances for Attendance to be received from the Storekeeper at Woolwich by a Quarterly Pay List.																		Permanent Salaries to be received at the Tower.
		During the First Five Years.		After Five Years' Service.		After Ten Years' Service.		After Fifteen Years' Service.		After Twenty Years' Service.		After Twenty-five Years' Service.		After Thirty Years' Service.						
		Allowance for each time.	Amount per Annum.	Allowance for each time.	Amount per Annum.	Allowance for each time.	Amount per Annum.	Allowance for each time.	Amount per Annum.	Allowance for each time.	Amount per Annum.	Allowance for each time.	Amount per Annum.	Allowance for each time.	Amount per Annum.					
		s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£
Lieutenant-Governor	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	300
Inspector	365	5 0	91 5 0	6 3	114 1 3	7 6	136 17 6	8 9	159 18 9	10 0	182 10 0	11 3	205 6 3	12 6	228 2 6	250
Professor of Mathematics	147	10 0	73 10 0	12 6	91 17 6	15 0	110 5 0	17 6	128 12 6	20 0	147 0 0	22 6	165 7 6	25 0	183 15 0	200
Ditto Fortification	147	10 0	73 10 0	12 6	91 17 6	15 0	110 5 0	17 6	128 12 6	20 0	147 0 0	22 6	165 7 6	25 0	183 15 0	200
Mathematical Master	252	6 0	75 12 0	7 0	88 4 0	0	100 16 0	9 0	113 8 0	10 0	126 0 0	11 0	138 12 0	12 0	151 4 0	130
Arithmetical ditto	294	2 6	36 15 0	3 3	47 15 6	4 6	58 16 0	4 9	69 16 6	5 6	80 17 0	6 3	91 17 6	7 0	102 18 0	130
French ditto	210	6 0	63 0 0	7 6	78 15 0	9 0	94 10 0	10 6	110 5 0	12 0	126 0 0	13 6	141 15 0	15 0	157 10 0	100
Fortification ditto	210	6 0	63 0 0	7 0	73 10 0	8 0	84 0 0	9 0	94 10 0	10 0	105 0 0	11 0	115 10 0	12 0	126 0 0	100
Landscape ditto	42	15 0	31 10 0	20 0	42 0 0	25 0	52 10 0	30 0	63 0 0	35 0	73 10 0	40 0	84 0 0	45 0	94 10 0	90
Figure Drawing ditto	126	10 0	63 0 0	11 6	72 9 0	13 0	81 18 0	14 6	91 7 0	16 0	100 16 0	17 6	110 5 0	19 0	119 14 0	90
Second French ditto	84	6 0	25 4 0	7 6	31 10 0	9 6	37 16 0	10 6	44 2 0	12 0	50 8 0	13 6	56 14 0	15 0	63 0 0	50
Fencing ditto	126	6 0	37 16 0	7 0	44 2 0	8 0	50 8 0	9 0	56 14 0	10 0	63 0 0	11 0	69 6 0	12 0	75 12 0	90
Dancing ditto	84	6 0	25 4 0	7 0	29 8 0	8 0	33 12 0	9 0	37 16 0	10 0	42 0 0	11 0	46 4 0	12 0	50 8 0	90
First Modeller	313	2 0	31 6 0	2 3	35 4 3	2 6	39 2 6	2 9	43 0 0	3 0	46 19 0	3 3	50 17 3	3 6	54 15 6	40
Second Modeller	313	1 6	23 9 6	1 9	27 7 9	2 0	31 6 0	2 3	35 4 3	2 6	39 2 6	2 9	48 0 9	3 0	46 19 0	30
Clerk	365	1 0	18 5 0	1 6	27 7 6	2 0	36 10 0	2 6	45 12 6	3 0	54 15 0	3 6	63 17 6	4 0	73 0 0	40

In the year 1829 the Fencing and Dancing Masters were discontinued, and a Chemical Lecturer appointed, and in 1836 three new Masters

		£	s.	d.	
One for plan drawing		91	5	0	
„ „ surveying	at salaries of	175	0	0	respectively.
„ „ German		160	0	0	

In the same year the salary of the Professor of Mathematics was raised to 491*l.* 4*s.* 0*d.* That of the French Master to 160*l.*, and that of the Drawing Master to 300*l.* per annum.

Assistant Mathematical Masters were employed from an early period, but their numbers varied at different times from three to seven as their services were more or less required. A similar variation existed in the number of the Instructors in Fortification.

The present staff is as follows, with the rate of pay and allowances received:—

	PRESENT STAFF.	Salary.			Salary added to Regimental Pay and other Allowances.		
		£	s.	d.	£	s.	d.
	Governor (in place of Lieut.-Governor)—a Colonel of Artillery	500	0	0	1,160	10	5
	MILITARY BRANCH.—(Cadet Company.)						
Military Staff.	One Second Captain Commanding	150	0	0	408	14	2
	One ditto for Practical Class	91	5	0	330	0	5
	Four First Lieutenants (each)	73	0	0	197	14	2
	One Quartermaster	54	15	0	225	1	8
	One Staff Sergeant	18	5	0	94	13	5½
	Seven Drill Sergeants (each)	13	13	9	63	17	6
	One Paymaster's Clerk	70	0	0	103	9	2
	One Assistant ditto	9	2	6	47	2	11
	Servants, &c.						
	CIVIL BRANCH.						
Educational Staff.	Inspector—Lieut.-Colonel of Artillery	300	0	0	686	3	9
	Assistant Inspector—Brevet Major R.E.	200	0	0	493	5	5
	Professor of Fortification—Lieut. Col. R.E.	250	0	0	678	10	5
	Two Second Captains, Assistant Instructors in ditto, (each)	91	5	0	422	1	0½
					393	17	11
	Professor of Mathematics	500	0	0			

Educational Staff

PRESENT STAFF.	Salary.	Salary added to Regimental Pay and other Allowances.
	£ s. d.	£ s. d.
Seven Mathematical Masters - - - (each)	200 0 0 rising to 400 0 0	
Master for Descriptive Geometry - - - -	300 0 0	
Master for Geometrical Drawing - - - -	300 0 0	
Second Master for Geometrical Drawing - - -	91 5 0	305 13 9
Drawing Master for Landscape - - - -	300 0 0	
Second ditto - - - - - -	300 0 0	
Master for Military Plan Drawing—Brevet Major R.A. -	350 0 0	57 0 10
Instructor in Surveying and Field Works—Capt. R.E. -	136 17 6	467 13 1½
Assistant ditto—Capt. R.A. - - - -	91 5 0	367 17 10
Instructor in Practical Artillery—2nd Capt. R.A. -	150 0 0	406 17 5
Assistant ditto—2nd Capt. and Brevet Major R.A. -	91 5 0	384 12 5
Four French Masters - - - - (each)	100 0 0 rising to 200 0 0	
Four German Masters - - - (each)	100 0 0 rising to 200 0 0	
Master for History and Geography - -	200 0 0	
Lecturer on Chemistry - - - - -	200 0 0	*240 0 0
Assistant to ditto - - - - - -	80 2 6	
Lecturer on Geology and Mineralogy - - -	200 0 0	
Lecturer on Practical Mechanics, Machinery, and Metallurgy	100 0 0	†500 0 0
Lecturer on Astronomy and Natural Philosophy - -	200 0 0	
Clerk - - - - - - -	180 0 0	
First Assistant ditto, Serjeant - - - -	22 16 3	73 0 0
Second ditto, Bombardier - - - - -	9 2 6	47 2 11
Gun Drill Sergeant (Practical Class) - - -	27 7 6	77 11 3
Modeller - - - - - - - -	125 0 0	
Modelling Smith - - - - - -	71 14 7	89 19 7
Servants, &c.		

Admission of Cadets.

System of nomination.

The admissions to the Royal Military Academy were made, until lately, upon the nomination of the Master-General of the Ordnance, each nominee being subjected to an examination before entrance.

Committee in 1835.

In the year 1835 a Committee sat, under the presidency of Lieutenant-Colonel Anson, the Principal Storekeeper of the Ordnance, to report upon the state of the Royal Military Academy.

Temporary alteration of age of admission.

It was decided, in consequence, that the age of admission should be not under 15 or above 17.

An attempt was made at the same time on their recommendation to introduce a modified form of competition for admission to the Academy; it was ordered that the number of candidates called up for examination out of those nominated by the Master General should be in the proportion of about four to three to that of the vacancies in the Institution; the intention being, supposing all, or nearly all, qualified, to select the best.

The unsuccessful candidates, in case of their having obtained the necessary qualification, were to be called up for the next examination. If, however, they had failed in so qualifying, a fresh recommendation from the Board was to be required to enable them to compete again.

The plan however failed, for this reason; those who succeeded in passing the examination were never more numerous than the vacancies which it was intended to fill.

Qualification for admission.

Correctness and proficiency in the following subjects were laid down as the necessary qualification for entrance:—

Writing in English from dictation.

Mathematics { First Book of Euclid.
Algebra, simple equations (including the extermination of two unknown quantities, but without surds).

* Allowance for Chemical materials. † Salary as Inspector of Machinery, Royal Arsenal.

French.—Easy translation and composition.
Geography.—General knowledge.
History.—A thorough knowledge of English, and a general knowledge of ancient and modern history.
The elements of drawing.

The entrance examination was to be conducted by "such Masters of the institution and other persons" as might be selected by the Master-General, before a Board composed of the Lieutenant-Governor, the Inspector, the Second Captain, and two Professors. As a regular rule, it was held half-yearly, on the first day of each vacation. The necessities of the Service have, however, from time to time been the cause of more frequent examinations for admission in the course of the year.*

Limits of age and qualifications up to the late war.

By the system in force up to the commencement of the late war, it was necessary that a candidate should have reached the age of ten years before his name could be placed on the list of appointments to Cadetships, and that of fourteen before he could be called up to the Entrance Examination, while sixteen was the maximum limit of age; after which, no admissions were made. A certificate of birth had to be sent in when the name was placed on the Cadet list, and every candidate on coming up for examination was required to produce a satisfactory certificate as to the sufficiency of his knowledge of the principles of Christianity from a clergyman of the religious body to which he belonged.

Graduated scale of qualifications.

The following table gives the amount of the qualifications respectively demanded in the case of candidates of fourteen, fourteen and a half, fifteen, and fifteen and a half years of age:—

From Candidates of Fourteen Years of Age.

English.—To write a good legible hand, and to write freely and correctly from dictation.
Arithmetic.—Including vulgar fractions, ratio, and proportion; the rule of three and compound proportion, decimals, duodecimals, involution, the extraction of the square and cube roots, simple interest.
Algebra.—The notation, and the four fundamental operations of addition, subtraction, multiplication, and division on algebraic quantities.
Geometry.—A clear comprehension and knowledge of the definitions, postulates, and axioms in the First Book of Euclid.
Classics.—To construe and parse Cæsar's Commentaries correctly.
French.—To read and translate any easy French author, with parsing.
German.—To read and write the written and printed characters, with competent knowledge of the declension of the articles, and personal pronouns, and of the conjugation of the auxiliary, active, and passive verbs.
Geography.—A general knowledge of countries, their position, capitals, rivers, mountains, and seas, &c.
History.—A competent knowledge of English history, and a general acquaintance with the leading points of ancient (sacred and profane) and modern history.
Drawing.—Instruction in drawing to the extent of copying an easy outline.
Printing.—To print the ordinary Roman character and italics, with neatness and facility

In addition to the above qualifications, the following proportionate advance in the mathematical course was expected from candidates who are above fourteen years of age:—

14 Years 6 Months.—Algebra.—Common multiples and common measures, algebraic fractions, simple equations, containing only one unknown quantity.
Geometry.—The first twenty-six propositions of the First Book of Euclid.
15 Years - Algebra.—Simple equations, containing two unknown quantities, with questions producing such equations; involution, evolution.
Geometry.—The First Book of Euclid.
15 Years 6 Months.—Algebra.—The various operations on surd and imaginary quantities.
Geometry.—The first two Books of Euclid.

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* In 1847 - - 5 Examinations were held, and 104 admitted.
„ 1848 - - - 4 „ „ 76 „
„ 1849 - - - 3 „ „ 56 „
„ 1851 - - - 3 „ „ 38 „

The entrance examination was conducted by the authorities of the Academy, under the superintendence of a Board, composed of the Lieutenant-Governor, the Inspector, and Assistant Inspector, and the result was reported by the Inspector of Studies, through the Lieutenant-Governor, to the Master-General of the Ordnance. Entrance examination.

If more candidates than the number required to fill up the actual vacancies acquitted themselves *to the perfect satisfaction of the Board*, they were allowed to be admitted as vacancies might afterwards occur; but to entitle them to this, their qualifications were in no respect to fall short of those specified in the preceding table.

In August 1855 admission to the Academy was made the subject of public competition. Returns of the further progress of the successful candidates, thirty-one in number, will be found appended to Colonel Portlock's evidence, and the prospectus of that, as well as of the subsequent examinations, are annexed to this portion of the Report. (*See* Annex 2.)

With the view of giving as exact an idea as possible of the course of studies pursued at the Academy under the present system, we have thought it advisable to quote from the Regulations of 1848 such parts as bear upon this subject:—

Course of Studies.

1. The course of studies at the Royal Military Academy is to be carried on by the Professors and Masters, according to the following details; and in case any Cadet shall fail to qualify himself in the Theoretical Course within four years, his name is to be submitted to the Master-General, for removal from the Institution.

Course of Mathematics.

2. Arithmetic, Algebra, Logarithms, Geometry, Application of Algebra to Geometry, Trigonometry, Heights and Distances, Analytical and Descriptive Geometry, Conic Sections, Spherical Trigonometry, Mensuration, the Differential and Integral Calculus, Mechanics, Hydrostatics, Hydrodynamics, and Pneumatics. The application of these principles will be shown in the Professor's Course of Lectures on Natural Philosophy, and a more extended application will be carried on in the Practical Class.

Manner of giving Instruction in Mathematics.

3. The Cadets of the Institution being arranged into classes, under the Professor and Mathematical Masters, each class is to be divided into such sections as in the judgment of the instructor will best ensure a steady and efficient progress. The principles of the subjects on which each section is engaged, with the demonstrations of theorems, and investigation of formulæ, and the mode of their application, are to be explained in the way of lecture, in such a manner as to enable the students to obtain a clear comprehension of them; and care will be taken during the lecture, to ascertain that they are so comprehended. The substance of the instruction thus given should, as much as possible, be presented in such a condensed form as will enable the student to embrace all its leading features in one view. A number of examples, sufficient to ensure proficiency in the application of principles to practice, should in all cases be furnished. In working these the student should be required, in the first place, to state clearly the principles on which the solution of the problem or question depends; and an orderly arrangement of the whole of the work should be insisted on. Before quitting any subject, a recapitulation shall be made of the principles which have been developed in the course of its investigation.

4. Vivâ voce examinations should occasionally be resorted to, unless they become superseded by examinations continually occurring during the course of instruction.

5. Unless some particular circumstances should occur to prevent it, instruction is to be given to each section of every class, once during such attendance, assigned to their branch of study. The investigations which have been gone through in the lecture will form the subject of study for the Cadets, in the intervals which occur in their instruction, and these intervals will be further and fully occupied in working examples.

6. Every Cadet is to be provided with blank books, in which he must enter the particulars of his mathematical instruction, in a regular but condensed form. The portions devoted to Geometry and Conic Sections are to contain only the figures and number of the proposition, and these are to be correctly and neatly drawn. The books in which these entries are made are to be inspected by the Professor or Master, in making out each Monthly Return, and continued carelessness or habitual inattention to neatness is to be reported to the Inspector.

7. The Cadets are also to be allowed blank books, in which they may enter the solutions or construction of particular problems and investigations which may have occurred out of the regular course of instruction, and which it may be advantageous to preserve. In all such cases, where diagrams occur, they are to be neatly and correctly drawn, according to the general conditions of the problem, *without* the aid of instruments.

8. The Professors and Masters, while they bear in mind the especial objects of Mathematical Science in the institution, and keep in view the tenor of the preceding regulations, are left each to his own judgment and talent in the art of tuition. Their aim should be

to keep alive the spirit of industry and activity, and the love of knowledge, in their pupils; they should develope, to the utmost of their power, the faculties of investigation, of arrangement, and of correct practical explanation, and to ensure, as far as possible, the benefit of a clear recollection of the knowledge acquired; they should not merely remind the Cadets of the probable operation of the Periodical Examinations, but at frequent intervals, by oral examination, or such other mode of revision as to them may appear best, ascertain the difference between real and apparent progress, and in all cases where the advance is not sound and satisfactory, cause the Student to retrace his steps.

Course of Fortification.

9. Each Cadet's work is to be so arranged that it may be bound in two books, viz., a large quarto, to consist of printed papers, manuscripts, and diagrams, and a folio atlas of plates; and these are to be produced at the Final Examination. All the constructions used as exercises in practical questions are to be made into finished drawings or neat diagrams, and the explanations or notes on them neatly written in the quarto book. Every plate is to be signed by the Professor or Master who receives it, with the date of its reception.

10. The Junior Classes will go through the following Preliminary Course of Instruction, preparatory to the study of Fortification:—

i. Practical Geometry, use of Mathematical Instruments, construction and use of scales of comparison for various units and trigonometrical scales. The constructions relating to these subjects will form seven or eight plates.

ii. Mode of representing the forms of solid bodies, by shading with Indian ink. Three plates.

iii. Elements of Perspective. Two plates.

iv. Plans, sections, and elevations of an ordinary simple building, with conventional colouring, to show the different substances; the technical names of the different parts to be printed. Two or three plates.

v. A gun, mortar, or howitzer, constructed and shaded, with the names of the different parts printed. One plate.

vi. Those who shall have completed this course before entering the Second Class, to construct plans and sections of the simplest field works from models, with conventional colouring and shading.

11. The Second Class will commence with the study of Fortification and descriptive Geometry, which will be carried on simultaneously, and in the following manner:—

12. *Descriptive Geometry.*

i. Projections of plane polygons.

ii. Elementary problems in practical solid Geometry.

iii. Application to plans on traces of field works or oblique sites.

iv. Tangent planes to irregular surfaces, as applicable to graphic construction of defilade.

v. Isometrical Projection.

vi. Perspective Projection.

vii. Application to the determination of shadows.

viii. Those Cadets who shall not have completed the first four subjects in the Second Class are to continue them in the First Class.

13. *Elementary Fortification.*—This study will commence with an explanation of the use and effect of the various weapons employed in modern warfare.

14. The Elementary Principles of *Defence*, illustrated by the Rudiments of Field Fortification.

i. *Profiles.* Definitions—Explanation of the uses and advantages of the different constructions, dimensions, and proportions; followed by practical constructions from proposed conditions.

ii. *Trace.* Treated of in the same manner as the profiles.

15. *Permanent Fortification.*—Two preliminary plates, one of a polygon with bastioned fronts, and the other of profiles. The names of the different parts to be printed, and the definitions inserted in the quarto book. Two plates.

16. Explanation by lectures of the general principles which regulate the construction of bastioned fronts; followed by practical constructions of profiles and tracing from proposed conditions.

17. Description of the different modes of communication in fortresses, such as flights of steps, ramps, passages, barriers, &c. illustrated by diagrams (or a plate).

18. Four systems in outline, viz., that usually called Vauban's First, Vauban's Third, Cormontaigne's, and the Modern System, in one plate.

19. General profiles of Vauban's First System and of the Modern System. One or two plates.

20. *The Modern System.*—

i. Plan on the largest scale, with every detail.

ii. Oblique sections and elevations on various lines drawn on the plan, at the discretion of the Instructor.

21. The First Class will commence with the *Attack of Fortresses*, to be illustrated by its application to a polygon with fronts of the Modern System.

i. Small drawings in detail of the different works used in siege operations; during the construction of which, the whole subject of the attack of fortresses is to be explained in a course of lectures. Six or seven plates.

ii. A polygon to be given by the Professor, of which the Cadet is to make his own attack, which is to be accompanied by a journal of operations, in which the working parties are to be estimated; the different night's work being marked as usual on the plan. Two large plates.

22. *Defence of Fortresses.*—Two plates, one to contain the plan and detail of a blinded battery, and the other for a plan for a casemated barrack.

23. Course of reasoning on the advantages, defects, and relative merits of the French bastioned systems, illustrated by the comparative difficulties a besieger would meet with in attacking them.

24. *Military Mining.*—

i. Two countermined systems, viz., Dufour's and that of Gumpertz and Le Brunn; with explanations of the principles which regulate the construction of countermines generally, and these in particular.

ii. Details of mining operations as practised at Chatham.

iii. Attack of countermined systems (as given by Dufour).

25. Additional outworks and detached works, such as tenaillons, counterguards, detached lunettes, horn and crown works, &c.; with explanation of their various uses, and conditions essential in their construction. Two or three plates.

26. Counterarched and detached revetments, escarp and counterscarp galleries, bombproofs, powder magazines, drawbridges, batardeaux, and sluices. Two or three plates.

27. Coehorn's System. Two or three plates.

28. Prussian System. Two or three plates.

29. Dufour's System. Two or three plates.

30. Graphic operations of defilade, applied in the first instance to a lunette as a bridge head, afterwards to a front of fortification.

31. Coast defences, martello tower, tours Maximiliennes, casemented hill forts.

32. *Field Fortification*, through the whole subject, terminating with an example of a field position, proposed by the Professor and fortified by the Cadet, who is to give written explanations of the different defensive arrangements he thinks it advisable to make.

33. The Systems of Montalembert, Chasseloup, de Laubat, and Carnot.

34. As the length of time during which Cadets remain at the Academy is likely to vary considerably, the Lieutenant-Governor will cause the above course to be abridged or extended, as promotion becomes more or less rapid, in order that those whose period is short may not lose any of the most essential parts of the subject, while others may have the full advantage of the more perfect system of instruction, which a lengthened period would afford.

When promotion is slow, some of the sections, from 25 to 31 inclusive, may be introduced in the Second Class.

35. *Drawing.*—

i. Plan drawing will be based upon the Contour System. The course of instruction will be printing, making scales, topographical masks, and conventional signs used in military plans, representing forms by shadows, drawing from models, copying, enlarging and reducing plans of the most remarkable positions.

ii. The Landscape Drawing Masters are to combine model drawing with landscape, and they are to explain to their pupils the simple principles of perspective, light, and shadow, applicable to each drawing they execute, so that when they are advanced to the Practical Class they may be able readily to make sketches and drawings of the ordnance, carriages, implements, machinery, &c., brought under their notice during the course of instruction.

36. *Course of Practical Instruction.*—

i. Those Cadets who have passed through their final examination in the theoretical course are to be advanced to the Practical Class in the Royal Arsenal.

ii. The course of instruction in this class is to consist of:—

Practical Artillery.
Practical Fortification in the Field.
Military Surveying and Sketching.
Riding.
Military Law.
Lectures on { Machinery. Practical Machinery. / Chemistry. / Geology. / Mineralogy. / Metallurgy. / Astronomy.

iii. The Officers instructing the class will superintend the whole progress of instruction, explaining the several processes, with the application and advantages of the various systems and constructions as they come under review.

iv. *Under the Instructors of Practical Artillery.*

At the Royal Military Repository.—The class is to be taken through the various drills, exercises, and shiftings taught at the Royal Military Repository, with as much instruction in the method of making military bridges as time will admit.

In the Department of the Inspector of Artillery.—Instruction will be given in the method of casting brass ordnance, the metals used, their characteristics, properties of the alloy, the nature of the furnace, &c. In the Boring Room the various machines, their construction and application, will be explained to the class; who will also see guns being submitted to the various operations carried on in their manufacture. The different proofs which guns have to undergo will be carefully gone into; with an explanation of the various instruments used, the proof charges for different natures of ordnance, and the mode of taking the specific gravity of bodies.

In the Royal Carriage Department.—The instruction will include the construction of all gun-carriages, traversing platforms, slide carriages, dwarf platforms, &c., used in the Military and Naval Service; with construction and application of the machinery used in the carriage department.

In the Royal Laboratory.—The class will go through such a complete course of laboratory instruction as will qualify them as Officers to superintend the making up of every nature of ammunition, store, and firework likely to be required in the service.

In the Marshes.—Practice with every nature of gun and projectile, including rockets, is to occupy a fair proportion of the time the class is under instruction in the Arsenal, it being understood that, while going through the theoretical course, practice with mortars and howitzers on the common has been carried on by the Cadets composing the class. The Cadets are to be supplied with note-books, in which they are to write down, while in the department, the explanation and descriptions given to them by the Instructor, and to draw such sketches as they may direct. Each Cadet, if time admits, should construct and draw a gun or carriage from actual measurement.

In the Class Room.—The Instructors will lecture at convenient times in the Class Room on Military subjects connected with the Artillery Service, of which the Cadets are to write notes: such as the method of making gunpowder, including the chemical properties of the constituent parts, their several virtues in the compound, and a short memoir on the history of gunpowder; a short historical sketch of the introduction of fire-arms; notes on modern artillery, with the general principles of the construction of guns, the various guns in the service, their uses, &c.; remarks on projectiles and practical gunnery, including ricochet; method of forming a breach, &c.; proportion of field batteries, &c.; principles which should guide an Artillery Officer in the field; remarks on Military carriages, with comparative merits of English and Foreign systems. The Instructors are further to explain the practice of Courts Martial, and the principles on which Military Law is grounded. On the evenings appointed for the lectures upon machinery, astronomy, geology, &c., in addition to the gentlemen appointed to deliver the lecture, one of the Military Instructors is to be present, who is to see that the Cadets pay proper attention and take notes of what is brought before them.

v. *Under the Instructors in Field Works.*

Field Works.—The Cadets are to be examined in throwing up in the field various works, the application of which has been taught them in the theoretical course, viz., the general arrangement and distribution of working parties; the mode of making fascines and gabions, &c.; tracing and executing first parallel and approaches of communication; opening second parallel by flying sap; executing different natures of sap; tracing and throwing up batteries with fascine, gabion, and sand-bag revetments; the construction of field powder magazines; laying platforms; profiling and constructing field works; raising French cavaliers; blinding guns; throwing up traverses and mining. It will not be necessary after the Cadets have acquired the proper mode of using the intrenching tools, &c. that they should complete all the works traced and commenced by them; the more laborious part may be finished on the days the Cadets are engaged in other studies by the party of Royal Sappers and Miners employed to assist in the instruction.

vi. *Under the Instructors in Surveying.*

The Cadets are to be made acquainted with the use of the theodolite and portable instruments best adapted for measuring angles, fixing points, and ascertaining distances in the field; sketching ground from nature in a quick and simple style; and the practice of judging of and ascertaining distances without instruments. To render the Cadets expert in these most useful and essential points, the Surveying Instructor's attention should be particularly directed, and he should be impressed with the importance of correctly surveying the features of a country for Military purposes, rather than for the minute delineations required in special surveys. The class should be instructed in tracing contour lines upon the ground, and in the use of the different instruments issued for the use of the class, including the determination of altitudes by the barometer and barometric thermometer.

37. *Examination.*

i. Shortly before the conclusion of each term of study, those Cadets who have gone through the whole of the Practical Course of Instruction are to undergo an

extended and searching vivâ voce examination by the Instructors and Lecturers in their respective branches of study, in the presence of the Inspector. To each question asked in the proposed examination, a certain numerical value is to be assigned by the Instructor and approved by the Inspector, and every Cadet is to receive the whole credit for each question put to him, or such portion of it as in the opinion of the Instructor and Inspector he may appear entitled to, according as the answer may manifest more or less knowledge of the subject.

To protect the nervous or less gifted, it must be understood that mere fluency of language or readiness of expression is not to be the test.

ii. The following relative values are to be attached to the several branches of study, viz. :—

NUMERICAL VALUES IN PRACTICAL CLASS.

Practical Artillery		260 or	5,200
Surveying		120 or	2,400
Field Works		60 or	1,200
Lectures on	Machinery	20 or	400
	Astronomy	20 or	400
	Geology	20 or	400

MODE OF ESTABLISHING SENIORITY WHEN BROUGHT FORWARD FOR PUBLIC EXAMINATION.

iii. The credit gained by each Cadet at this examination in the Practical Class, is to be added to that assigned to him in the Theoretical Class, and the Cadet having the highest combined numerical credit, is to stand first in the class when brought forward for public examination, and the others, in succession, according to the amount of their combined credits, and the amounts of such combined credits will finally settle the position of the Cadet in regard to his commission in either of the Ordnance Corps, instead of that point being fixed, as at present, on his passing his final examination in the Theoretical Classes only.

iv. When any part of the Practical Class are examined before a Board of Officers, previously to being recommended for commissions, the Lieutenant-Governor will lay before the Board returns showing the general conduct of each individual during the time he has been in the Practical Class, with such observations as he may judge proper.

In deciding on the merits of each candidate, the Board of Officers superintending the examinations are to give to good military conduct its due weight, and thus again evince to the Cadets that proficiency in study will not avail, unless accompanied by a zealous performance of their duties as Under Officers and Corporals, gentlemanlike behaviour, and regularity of deportment. Therefore, after taking into consideration the returns of general conduct and the Lieutenant-Governor's remarks attached thereto, should the Board consider that the position of any Cadet ought to be changed, they are to embody a recommendation to that effect in their report to the Master-General.

LECTURES.

On Natural and Experimental Philosophy.

38. Besides the Instructions which the Professor of Mathematics gives to the Gentlemen Cadets in the First Class, he is to deliver a regular course of lectures on Natural and Experimental Philosophy to the Cadets in the First and Second Classes, or to any number of Cadets whom the Lieutenant-Governor may direct to attend.

These lectures are to be delivered weekly, and be so arranged that the entire course may usually, if not always, be comprehended within the year. They are to be illustrative of the principles of statics, dynamics, hydrostatics, hydrodynamics, and pneumatics; of the elementary principles of sidereal and planetary astronomy, and when circumstances will permit, of those of optics, and of the phenomena of magnetism. Principles and theorems, where they admit of it, are to be elucidated by experiments. In all the most interesting cases, the mode of operation of mechanical, hydraulic, and pneumatic instruments is to be illustrated by working models, capable of exhibiting the proposed effects, as well as of confirming the theoretic truths on which they depend; and the most important applications, especially such as are connected with the military profession, and the construction of military machines, are to be introduced.

The Cadets who attend these lectures are to be furnished with blank note-books; and they are required in the first place, during the lecture to take notes of the principles, illustrations, experiments, &c. successively brought forward; and afterwards make a more careful entry of them in books provided for the purpose, and in the order adopted by the Professor, together with sketches of the principal instruments exhibited during the lectures.

The Inspector will call for these note-books, and examine them at his leisure, and make such remarks as he may deem necessary.

On Chemistry.

39. A course, consisting of not less than twenty-five lectures, is to be delivered annually to the Cadets of the Practical Class, and First and Second Classes.

The object of the lectures, after explaining the principles of chemistry, is to be directed more especially to such subjects as are connected with the professional knowledge necessary for Officers of Artillery and Engineers, and he is to take care that the progressive improvements in chemistry are embodied in the course.

Every Cadet is to be furnished with a small book, in which he is to take his notes, which are to be occasionally examined by the Inspector. From these notes each Cadet is afterwards to enter, in a more detailed form, in a book for that purpose, the knowledge which he has gained; and these books are to be finally inspected by the Lecturer, who is to report upon the relative merits of each.

On Mechanics, Machinery, and Metallurgy, and their Application to Practical Purposes.

40. Two courses, consisting of twenty lectures each, are to be delivered annually to the Cadets of the Practical Class.

The object of these lectures is to be directed to the practical application of the principles of mechanics and machinery, and they are to be illustrated by working models of the various machines treated of, particularly the steam engine, explaining the difference when it is used for stationary, naval, or locomotive purposes, turning lathes, planing and boring machines, &c.

In the lectures on metallurgy, specimens of the several metals and their ores are to be exhibited in explanation of the subject; the method of separating the metals from their ores, and the art of working them for military and other purposes, will be particularly dwelt upon, and fully explained.

The Cadets are to be supplied with note-books into which they are to write down at the time the explanations and descriptions given by the Lecturer, and to make such sketches of the machinery as they may think proper. These notes and sketches are afterwards to be drawn out and written fairly in a book for that purpose, showing the knowledge they have obtained, and then submitted to the Lecturer, who will report on the relative merits of each.

On Astronomy.

41. The course is to consist of forty lectures, to be delivered annually to the Cadets of the Practical Class.

In these lectures, not only the elementary principles of sidereal and planetary astronomy will be explained, but practical examples, with the use of the instruments, will be afforded when the weather will permit.

The Cadets are to be furnished with blank books for notes which they are to take during the lecture, of the principles and illustrations given by the Lecturer, and of the practical examples he may teach them, and afterwards make a more careful entry of them in books provided for the purpose, together with sketches of the principal instruments used during the lectures.

On Mineralogy and Geology.

42. The course is to consist of forty lectures, to be delivered to the Cadets of the Practical Class.

In this course of lectures the elementary principles of the science will be taught, and specimens of the several classes of minerals, geological strata, and of the different metals and their ores, will be exhibited in explanation of the subject treated of.

The Cadets will have notes of these lectures, which must be fairly transcribed and submitted to the Lecturer, who will give his opinion on their relative merits.

43. On the evenings appointed for the lectures upon machinery, astronomy, mineralogy, &c., in addition to the gentleman appointed to deliver the lecture, one of the Military Instructors is to be present, who is to see that the Cadets pay proper attention, and take notes of what is brought before them.

On History and Geography.

44. The Master for History and Geography, in addition to his present system of instruction, is to give a lecture on history, &c., to the First and Second Classes, in each week. The Cadets are to take notice of the prominent parts of each lecture for future reference, for which purpose blank books will be issued to them.

CLASS BOOKS TO BE USED.

1. In order to preserve such a degree of uniformity as is practicably desirable under the different Masters, the same class books are to be employed throughout the Institution in the respective branches of study.

2. *For the Mathematical Course.*—The Course of Mathematics drawn up by the Masters for the use of the Institution, edited by Captain Harness, Royal Engineers. The Masters are, however, at liberty, with the concurrence of the Professor and the Inspector, to introduce other demonstrations, rules, or examples for the purpose of more completely explaining or confirming the principles of that part of the course especially intrusted to them.

3. *For the Course of Fortification.*—Captain Macaulay's Treatise on Field Fortification; Treatises on Permanent Fortification, Attack and Defence of Fortresses, and Military Mines, compiled by the Professor and Instructors, and printed for the Academy; the plates to illustrate them being constructed by the Cadets, of these each Cadet is to possess a copy. Copies of the following works are to be used by the Professor and Instructors as books of reference:—Vauban's Attack and Defence of Places, by M. Angoyat and Baron Valazé, edited 1829; Ouvres Posthumes de Cormontaigne; Essai Général, &c., de Bousmard; Elémens de Fortification, de St. Paul; Traité Elémentaire, de Guy de Vernon; Traité de Fortification permanente, de Dufour; Architecture des Forteresses, de Mandar; Mémoire sur la Fortification, de Choumarra; De la Défence de Places Fortes, de Carnot; Mémorial pour les Travaux de la Guerre, de Dufour; Cours Elémentaire de Fortification, de Savart; Cours Elémentaire de Fortification, d'Imbert; Traité de Fortification Souterraine, de Monzé; Traité de Fortification Souterraine, de Gillot; Traité des Mines, de Gumpertz et Le Brun; Journals of the Seiges in Spain and Portugal, by Major-General Sir John Jones; Rules for the Practical Operations of a Siege, by Major-General Sir Charles Pasley; Collection of Professional Papers connected with the Duties of the Royal Engineers.

4. *For French.*—Tarver's Choix; Tarver's Grammar; Nugent's Dictionary; Lord Dover's Lives.

5. *For German.*—Troppaneger's Grammar; Flügel's Dictionary; Kohlrauseh's History; Feiling's Course of Literature.

6. *For History.*—Gleig's Abridged History of England; Bath's General History. *For Geography.*—Sullivan's Geography; Cruchley's Atlas.

7. *For Surveying.*—Jackson's Military Surveying.

8. *For Practical Artillery.*—Instructions and Regulations for the Service and Management of Heavy Ordnance; Field Battery Exercise; Artillerist's Manual.

9. *For Field Works.*—Pasley's Treatise on Fortification.

The following tables will show the distribution of time, the hours daily devoted to study, and the number of hours allotted weekly to each subject:—

TIME TABLE of that Portion of the Day not occupied by STUDY.

Theoretical Class.		Practical Class.	
Summer Months.	Winter Months.	Summer Months.	Winter Months.
No Riding Drill. Mid-day Parade at ¼ past 11, and General Drills until about ¼ to 1 o'clock. Dinner at 1 o'clock. Afternoon Squad Drill between ½ to 5 and 6 o'clock. Roll Call at 10, and "Out-lights" at 10½.	No Riding Drill. Mid-day Parade at ¼ past 12, and General Drill for half an hour. Dinner at 1 o'clock. Afternoon Squad Drill when possible for half an hour, from ½ past 4. Roll Call at 9, and "Out-lights" at ½ past 9.	Mid-day Parade at ¼ past 11. Riding Drill is for one hour between that time and 1 o'clock about twice a week. The class going to ride drills until the hour for marching to the School. General Drill between the above parade and 1 o'clock for all not at the Riding School. Dinner at ¼ past 4 every day except Saturday, when it is earlier to enable Cadets to go on leave. Roll Call is at 10 o'clock, and "Out-lights" at 11. The Competitive Class conforms to the above with the exception of riding.	Mid-day Parade at ¼ past 12; riding from that time until 1 o'clock. Other drills also carried on. Dinner at ½ to 4 o'clock. Roll Call at 9, and "Out-lights" at 10.
N.B.—The time between Tea and Roll is taken up in fencing, &c., the work-shop and bird-stuffing, for those who wish to learn.—There is no afternoon drill on Wednesday.		N.B.—The time between Tea and Roll Call is taken up in fencing, &c., for those who wish to learn.	

Time devoted to study by the Theoretical Classes, Upper Barracks.

Summer Season, from 1 April to 14 October.		Winter Season, from 15 October to 31 March.	
Morning	8 to 11	Morning	9 to 12
Afternoon	2 to 4½	Afternoon	2 to 4
Evening	6 to 8	Evening	5 to 7

Saturday morning, 8 to 11; afterwards drill.

Practical Class.

On Monday, Tuesday, Wednesday, Thursday, Friday	Morning	8 to 11	On Monday, Tuesday, Wednesday, Thursday, Friday	Morning	9 to 12
	Afternoon	1½ to 4		Afternoon	1½ to 3½
	Evening	5¾ to 7¾		Evening	4¾ to 6¾
Saturday	Morning	8 to 11 and 11¼ to 1¼	Saturday	Morning	9 to 12 and 12¼ to 2¼

Subjects of Study.	Number of Hours allotted weekly to each Subject. (Summer Season.)					Observations.
	Theoretical Classes.				Practical Class.	
	4th.	3rd.	2nd.	1st.		
Mathematics	14	14	14	14	–	
Fortification	–	–	–	11	–	
Do. and Descriptive Geometry	–	–	11	–	–	
French	$5\frac{1}{4}$	$5\frac{1}{4}$	4	4	–	
German	$5\frac{1}{4}$	$5\frac{1}{4}$	4	4	–	
Plan Drawing	9	$7\frac{1}{2}$	$2\frac{1}{2}$	–	–	
Geometrical Drawing	$7\frac{1}{2}$	9	–	–	–	
Landscape Drawing	–	–	$5\frac{1}{2}$	$5\frac{1}{2}$	–	
History and Geography	2	2	2	–	–	
Chemical Lectures	–	–	–	$2\frac{1}{2}$	–	
Philosophical Lectures	–	–	–	2	–	
Totals	43	43	43	43		
Practical Artillery					19	
Surveying and Field Works					$15\frac{1}{2}$	A lecture on Machinery to one half the class out of this time.
Analytical Instruction in Chemistry					$2\frac{1}{2}$	
Course of Applied Chemistry					2	
Mechanics, Practical Astronomy, and Metallurgy					2	
Lectures on Geology and Mineralogy					2	
Total					43	

Subjects of Study.	Number of Hours allotted weekly to each Subject. (Winter Season.)					Observations.
	Theoretical Classes.				Practical Class.	
	4th.	3rd.	2nd.	1st.		
Mathematics	13	13	13	13		
Fortification	–	–	–	10		
Do. and Descriptive Geometry	–	–	10	–		
French	5	5	4	4		
German	5	5	4	4		
Plan Drawing	9	6	2	–		
Geometrical Drawing	6	9	–	–		
Landscape Drawing	–	–	5	5		
History and Geography	2	2	2	–		
Chemical Lectures	–	–	–	2		
Philosophical Lectures	–	–	–	2		
Totals	40	40	40	40		
Practical Artillery					18	
Surveying and Field Works					14	
Analytical Instruction in Chemistry					2	
Course of Applied Chemistry					2	
Mechanics, Practical Astronomy, and Metallurgy					2	
Lectures on Geology and Mineralogy					2	
Total					40	

Half-yearly periodical examinations.

Periodical examinations of the Cadets have long been the custom at the Academy. They were conducted half-yearly by the Masters, and fixed the rank to be taken by Cadets in their passage from one "Academy" or Class to another. At the conclusion of the first year's residence of each Cadet, the Masters stated their opinion as to the probability of his making sufficient progress to qualify within the fixed period for a commission.

We find in 1830 the examination at the close of the Theoretical Course conductedby officers otherwise unconnected with the Institution. They were paid

at the rate of 50*l.* per annum, and were allowed free quarters if there were any vacant. This system, however, lasted but a short time, in consequence apparently of the opinion expressed by the authorities at the Academy.

Probationary examination.

In case of the report being unsatisfactory, he was then examined in presence of a Board, consisting of the Lieutenant-Governor, the Inspector, and Assistant Inspector. This examination was termed the Probationary Examination; and had for its object the reconsideration of the decision of the Masters in cases where it had been unfavourable to the continuance of a Cadet at the Academy.

The regular periods of the half-yearly examinations were from time to time anticipated, and a greater number held within the year.

The limit of the theoretical course was fixed at four years, and the practical course at one year more; but Cadets who had qualified themselves for their commissions in a shorter period obtained them as vacancies occurred.

During the first years of the Academy's existence, the average age of the Cadets was so low that few were considered old enough for commissions on the completion of their course; but of late years it has been unusual for a Cadet to remain at the Academy for the five years fixed as the maximum of residence.*

The relative credits attached to the several branches of study carried on in the Theoretical and Practical Classes will be found in the following table; in order to simplify their evaluation, the numerical values for each subject were multiplied by 20, and thus raised to the same ratio:—

Scale of Theoretical Class.

Mathematics	250 × 20 =	5,000
Fortification	225 × 20 =	4,500
French	65 × 20 =	1,300
German	65 × 20 =	1,300
Plan Drawing	65 × 20 =	1,300
Landscape Drawing	65 × 20 =	1,300
History and Geography	65 × 20 =	1,300
	800 20	16,000

Scale of Practical Class.

Practical Artillery	260 × 20 =	5,200
Surveying	120 × 20 =	2,400
Field Works	60 × 20 =	1,200
Lectures on Machinery, &c.	20 × 20 =	400
„ Astronomy, &c.	20 × 20 =	400
„ Geology, &c.	20 × 20 =	400
Total	500 × 20 =	10,000

Examination at the close of the Theoretical Course:

The Professors of Mathematics and Fortification, and the French, German, and Historical and Geographical Masters, made a periodical return of their pupils in the first class in each subject, as to the fitness of each to be called up for the Public Examination, which concluded the Theoretical Course. The relative rank which the new officers were to occupy in their Corps was first fixed by the last periodical Examination, the credits obtained at which were subsequently added to those acquired in the Practical Class.

After passing it, the Cadets entered the Practical Class, which was held from the year 1840 to 1855 in the Arsenal, and towards the close of which a paper was circulated among the Cadets, by signing which they intimated their choice of the Artillery or Engineers, as the case might be. The success of this choice depended, of course, upon the relative position to their fellow Cadets which they had secured, and the number of vacancies proposed to be filled up in the Corps, in which they desired to be commissioned.

At the close of the Practical Course.

Of late years, the Examination at the close of the Practical Course has been made to tell upon the relative position of the Cadets; but it is obviously impossible that those who have succeeded in the previous Examinations should

* In 1814, however, we found that there were in the Academy—

Five	Cadets	above	5 years.
Thirteen	„	„	4 „
Two	„	„	3 „
Nine	„	„	2 „

fail so far in this as to be deprived of their Commissions. The scale of credits for the Examinations in the Practical Class is given above.

Board for superintendence of final Examinations.

The Public Examinations, the one at the close of the Theoretical, and the other at the termination of the Practical Course, were conducted by the Officers who had had the charge of the instruction of the Cadets, who were the subjects of them, in the presence of a Board, consisting of the Director-General of Artillery, the Inspector-General of Fortifications, the Commandant of the Garrison, the Lieutenant-Governor of the Academy, the Deputy Adjutant-General, and the Commanding Royal Engineer at Woolwich.

The Public Examinations, whether in the Theoretical or Practical Class, have never had any practical weight attached to them, the rank of the Cadets depending entirely on the last periodical Examination in each class conducted solely by the Professors and Masters.

Discipline.

Governor.

The whole charge of the Academy and the entire responsibility of its supervision rests, as has been already stated, in the Lieutenant-Governor, or, as he is now styled, "the Governor."

Second Captain Commanding.

The Cadets are under the immediate authority of the Second Captain commanding the Company;* another Officer, at present a Second Captain of Artillery, having the charge of the Practical Class, which is considered as a detachment from the Cadet Company.

Under Officers and Corporals.

A certain number of Under Officers and Corporals are appointed from among the Cadets, whose position and authority, viewed apart from its military character, resemble to a great extent that of the monitors in some of our public schools.

Punishments.

The following are the punishments to which Cadets of all ranks are liable:—

Dismissal or discharge for grave offences.
Arrest to room, with tasks.
Confinement to the Enclosure.
Restriction from indulgences and leave.
Reprehension, private; public, in writing in the Orderly Book, and placed in the Hall or Library.

The Cadets not Under Officers are liable to *solitary confinement*, and another punishment termed "*separation from companions*," which consists in parading apart from the Company, and being separated from them at meals and studies; and the Under Officers may be reduced from their grade for neglect of duty, misconduct, or incapacity. The Chaplain is bound to visit every Cadet in solitary confinement, after twelve hours, and at least once during twenty-four hours afterwards.

Consequences of dismissal.

In case of any Cadet being dismissed for misconduct, the fact is communicated to the Commander-in-Chief, the First Lord of the Admiralty, and to the East India Company, in order to prevent his being admitted either into Her Majesty's service or that of the Company.

Powers of Under Officers.

The Under Officers have the power of ordering any Cadet into arrest until the next morning's parade, when the Corporal on duty reports it to the Subaltern on duty, who in his return reports it to the Second Captain commanding. This Officer in dealing with slight cases uses his own discretion, but is bound to submit more serious ones to the Governor for his decision.

Roll call.

The Subaltern Officers go the rounds at 9 P.M. in the winter and 10 P.M. in the summer, to hear the rolls called over, after which lights are strictly prohibited.

Military character of the discipline.

Pledge not to leave without discharge.

Courts martial.

It will be seen that the discipline is strictly military, and its character as such is still more strongly marked by the fact that every Cadet is bound on entrance to take a pledge that he will not leave the Institution without being regularly discharged.

And not only was this the case, but in the early years of the Academy's existence, the Cadets were brought before Court-martials in order to their dismissal; they were, however, occasionally restored by the Master-General on the solicitation of their friends. Instances of this occurred in the year

* This title does not denote the rank of the Officer, but arises from the fact that the Cadet Company was supposed to be under the command of the Master-General of the Ordnance as its Captain. The present Second Captain commanding is a full Captain of Artillery.

1766 and in the year 1774. When the Lower Academy was formed, it was thought necessary to make an order that the Cadets who constituted it should be subject to corporal punishment, at the discretion of the Lieutenant-Governor or Commanding Officer, without the formality of a Court-martial.

Appeals.

All combinations amongst the Cadets are looked upon as a most serious offence; individual Cadets have, however, a right of appeal against the decision of any Officer to that Officer's superior; either party, if not satisfied, having a further appeal to the Governor open to them; but a vexatious or groundless appeal on the part of a Cadet is treated as an offence and punished accordingly.

Pay of Cadets, &c.

The pay credited to the Cadets for the expenses of their mess, &c. was fixed in July last at 2*s.* 4*d.* a day for the Practical Class and those who had been admitted on a competitive examination, and at 2*s.* 2*d.* for the others, with an allowance of 6*d.* a day for clothing.* The Second Captain commanding, who acts as Paymaster to the Company, pays weekly to each Cadet the following sums as pocket money:—

Practical Class.

	s.	*d.*
Under Officers	3	6
Cadets	3	0

Theoretical Class.

Corporals	3	0
Heads of rooms and Cadets wearing badges	2	0
Other Cadets	1	0

The contributions paid by their friends for their education will be found below.

Economy of the Institution.

By the original Warrant constituting the Academy, 500*l.* per annum was fixed as the maximum which was to be charged on the Treasury of the Ordnance. In the same year, however, (1741,) 1,000*l.* was included in the Ordnance estimates for this purpose, a sum which continued to be voted annually till 1771, when the item was increased to 1,364*l.* 14*s.*

The augmentations from the commencement of the vote will be found in Annex 3, page 305.

Annual contributions of Cadets.

By order dated the 21st of June 1831 it was settled that the friends of Cadets should thenceforward pay a fixed annual contribution to the Academy, regulated by the following scale:—

	£	
For Cadets, not sons of Officers in the Army or Navy	80	per annum.
Sons of Admirals or Generals	60	„
Sons of Captains and Commanders in the Navy, and Colonels and Regimental Field Officers in the Army	50	„
Sons of all Officers in the Army and Navy under the above ranks	40	„
Sons of Officers of the Army and Navy who had died in the service, and whose families were proved to be left in pecuniary distress	20	„

This order came into operation on the 30th of June of the same year, and at the end of the financial year, on the 31st March 1832, the contributions from Cadets amounted to 1,476*l.* The present scale of contributions, which is higher, will be found appended in Annex 2, Table D. The sons of Civilians now pay 125*l.* per annum, and a sum of 22*l.* 10*s.* to meet the expense of uniform, books, &c. is demanded of all Cadets on entrance.

The variations in the amount of these contributions to the year 1840, together with a statement for the years 1846–1855 of the annual receipts and expenditure on account of the Academy and the preparatory school at Carshalton, which had been just established, are given in Annex 4 at the end of this portion of the Report.

To this is appended, for the sake of comparison, a similar statement of the receipts and expenditure on account of the Royal Military College, Sandhurst, for the same period.

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* It is in contemplation to raise the messing allowance to 2*s.* 6*d.* for all Cadets.

Annex 1.

Vacancies in the Corps of Artillery and Engineers, and Commissions granted during the Years 1840–1851.

	R.A.	R.E.	Total.
Vacancies 1st January 1840	26	12	38
Vacancies in 1840	20	6	26
Commissions in 1840	9	11	20
Vacancies 1st January 1841	37	7	44
Vacancies in 1841	35*	15*	50
Commissions in 1841	12	6	18
Vacancies 1st January 1842	60	16	76
Vacancies in 1842	22	4	26
Commissions in 1842	29	11	40
Vacancies 1st January 1843	53	9	62
Vacancies in 1843	21	12	33
Commissions in 1843	45	13	58
Vacancies 1st January 1844	29	8	37
Vacancies in 1844	19	9	28
Commissions in 1844	29	11	40
Vacancies 1st January 1845	19	6	25
Vacancies in 1845	23	8	31
Commissions in 1845	21	14	35
Vacancies 1st January 1846	21	—	21
Vacancies in 1846	76†	59†	135
Commissions in 1846	40	24	64
Vacancies 1st January 1847	57	35	92
Vacancies in 1847	16	14	30
Commissions in 1847	67	34	101
Vacancies 1st January 1848	6	15	21
Vacancies in 1848	104‡	5	109
Commissions in 1848	29	12	41
Vacancies 1st January 1849	81	8	89
Vacancies in 1849	13	6	19
Commissions in 1849	35	4	39
Vacancies 1st January 1850	59	10	69
Vacancies in 1850	20	5	25
Commissions in 1850	35	6	41
Vacancies 1st January 1851	44	9	53
Vacancies in 1851	18	9	27
Commissions in 1851	30	6	36
Vacancies 1st January 1852	32	12	44

* Brevet, R.A. 9, R.E. 5.

† Augmentation, R.A. 46, R.E. 47 ; Brevet, R.A. 10, R.E. 8 ; Casualties, R.A. 20, R.E. 4.

‡ Augmentations, R.A. 92 ; Casualties, R.A. 12.

Annex 2.

A.

Prospectus of the Examination in August 1855.

The examination for appointments to the Royal Artillery and Royal Engineers, which was intended to take place on the 11th July, is postponed until the 1st of August.

Forty appointments will then be made to the Senior Practical Class at Woolwich, the candidates for which must be between the ages of seventeen and nineteen.

Twenty other appointments will, at the same time, be made to Provisional Commissions, the candidates for which must be between the ages of nineteen and twenty-one years.

The gentlemen appointed to these Commissions will be placed under the Director of Military Studies at Woolwich. The appointments will be determined by the results of the examination.

Each candidate will be examined in the elements of pure mathematics, and in any two or more of the following subjects, which he may himself select:—

1. English Composition, Literature, and History.
2. Greek ditto.
3. Latin ditto.
4. French ditto.
5. German ditto.
6. Mixed Mathematics.
7. Natural Sciences.
8. Moral Sciences, that is, Logic, Mental, Moral, and Political Philosophy.

The standard of attainment expected in the candidates is that ordinarily reached in the upper classes of the public schools, or in the first year of residence in the universities.

To meet the case of gentlemen who have been pursuing the special studies recommended in a syllabus formerly issued by the Lieutenant-General of the Ordnance, a section of questions in the paper on "mixed mathematics" will be set apart for those studies:—

The examiners will be appointed by the Secretary of State for the War Department.

The examinations will be open to all natural-born subjects of Her Majesty.

The examination will be held in the Hall of King's College, London, on Wednesday, the 1st of August, at 10 o'clock in the morning.

Every candidate must transmit to the Secretary of State for the War Department before the 25th July:—

1. A certificate of his age within the limits above mentioned.
2. A certificate, signed by a physician or surgeon, of his having no disease, constitutional affection, or bodily infirmity, unfitting him for military service.
3. A certificate of good moral character, signed by a clergyman of the persuasion to which he belongs, and by the head of the school or college at which he has last received his education, or such other proof of good moral character as will be satisfactory to the Secretary of State.
4. A statement of the branches of knowledge in which he desires to be examined.

War Department, 22*nd June* 1855. W. Monsell.

B.

Prospectus of the Examination in January 1856.

Appointments to Provisional Commissions in the Royal Artillery will take place early in the ensuing year. The candidates for these appointments must be between the ages of twenty and twenty-two years; and those appointed will be placed under the Director of Artillery Studies, at Woolwich.

At the same time appointments will be made to the Practical Class of the Royal Military Academy, at Woolwich, the candidates for which must be between the ages of eighteen and twenty years.

The appointments in both these classes will be determined by the result of a competing examination, to be held in January next, on a day to be hereafter named.

No candidate will be eligible for examination, who does not exhibit a reasonable proficiency in drawing: namely, elementary geometrical drawing, including the use of drawing instruments, and other machinery, architectural, engineering, or landscape drawing.

The subjects of the competing examination will be:—

	Marks.
Mathematics, Pure and Mixed, to which will be allotted - - -	3,500
Of which one-third will be given to problems.	
Language, Literature, Geography, and History of ancient Rome - -	1,000
Ditto ditto ditto ancient Greece - -	750
Ditto ditto ditto France - - -	1,000
Ditto ditto ditto Germany - - -	750
The examination in French and German will be both written and *vivâ voce*.	
English Language and Literature, Composition, History, and Geography -	1,250
Experimental Sciences:—Chemistry, Heat, Electricity, including Magnetism	1,000
Natural Sciences:—Mineralogy and Geology - - - - -	500
Moral and Political Sciences - - - - - -	1,000

The examination in mathematics will precede that in the other subjects, and the number of candidates will be reduced to two-thirds of the total numbers by the result of this examination.

Each candidate may select from the other subjects of examination those in which he desires to be examined, but no candidate will be allowed to count the marks gained in any subject, unless those marks shall at least amount to one-sixth of the total number of marks allotted to that subject.

The examiners will be appointed by the Secretary of State for the War Department.

Every candidate must transmit to the Secretary of State,—

1st.—An extract from the register of his baptism: or, in default of that, a certificate of age verified by affidavit.

2nd.—A certificate of good moral character, signed by a clergyman of the parish or of the persuasion to which he belongs, and by the tutor or head of the school or college at which he has received his education, for at least two years; or such other proof of good moral character as will be satisfactory to the Secretary of State.

3rd.—A statement of the subjects of examination, as far as the above regulations leave a selection to the candidate, in which he may desire to be examined.

Each candidate will be inspected by Military Surgeons, in order to ascertain that he is free from any bodily defects or ailments calculated to interfere with the performance of military duties.

Each candidate, previous to the examination, must lodge 5*l.* at Messrs. Cox and Co., army agent, Craig's-court, Charing-cross, towards the expense of the examination.

War Department, Pall Mall, 4th October 1855. CHARLES HAWKER.

C.

PROSPECTUS OF THE EXAMINATION IN JULY 1856.

Revised Prospectus of Examinations for Appointments to the Royal Artillery, and Admissions to the Royal Military Academy at Woolwich.

Some alterations consequent upon the restoration of peace have been made in the system proposed for carrying on the education of successful candidates for the Royal Artillery and Royal Engineers at Woolwich Academy. The following notice is therefore substituted for the prospectus, dated the 7th April.

An Examination for Provisional Commissions in the Royal Artillery will commence on Monday, 30th June, at King's College, Strand. About twenty appointments will be made, supposing a sufficient number of competent persons to present themselves. The candidates must be between the ages of twenty and twenty-three years; and those appointed will be gazetted to Lieutenancies in the Royal Artillery, in the first instance, with temporary rank. They will be placed for instruction, for about six months, under the Director of Artillery Studies at Woolwich, and on completing their course, to the satisfaction of the Secretary of State for War, will receive permanent commission, with the date of their temporary appointment. They will receive the pay of their rank (viz., 5*s.* 7*d.* per diem) from the date of their names appearing in the Gazette; but will be required to contribute a deposit of 20*l.* for the purchase of books, instruments, &c.

At the same time, provided a sufficient number are found competent, about thirty admissions will be made to the Royal Military Academy at Woolwich, the candidates for which must be between the ages of seventeen and twenty years. Gentlemen admitted, will remain under instruction until they are sufficiently advanced in scientific knowledge to pass a satisfactory examination, and they will then receive commissions in the Royal Artillery and Royal Engineers, according to their proficiency. They will be required to pay a contribution of 62*l.* 10*s.* for each half year of the time during which they remain at the Academy.

The appointments in both these classes will be determined by the result of a competitive examination. The days and subjects of examination will be as follows, viz.:

			Marks.
Tuesday,	1 July.	Pure Mathematics	2,000
Wednesday,	2 „	Mixed Mathematics, *i. e.*, Statics, Dynamics, and Hydrostatics	1,500
Thursday,	3 „	Language, Literature, Geography, and History of Ancient Rome	1,000
Friday,	4 „	Language, Literature, Geography, and History of Ancient Greece	750
Saturday,	5 „	Language, Literature, Geography, and History of France	1,000
Monday,	7 „	Language, Literature, Geography, and History of Germany	750

The examination in French and German will be both written and *vivâ voce*.

Tuesday,	8 July.	English Language, Literature, Composition, History, and Geography	1,250
Wednesday,	9 „	Experimental Sciences, *i. e.*, Chemistry, Heat, Electricity, including Magnetism	1,000
Thursday,	10 „	Natural Sciences, Mineralogy, and Geology	750
Friday,	11 „	Moral and Political Sciences	1,000
Saturday,	12 „	Drawing, *i. e.*, Elementary Geometrical Drawing, including the use of Drawing Instruments, and either Machinery, Architectural, Engineering, or Landscape Drawing	750

The examination will commence on each of these days at ten o'clock in the morning, and continue until one o'clock. It will re-commence at two o'clock, and continue until five. No candidate will be admitted after the hour fixed for the commencement of the examination.

Every candidate must be examined in pure mathematics; and no one who does not obtain at least one-fifth of the marks allotted to that subject will be eligible for an appointment.

From the other subjects of examination each candidate may select those in which he desires to be examined; but no one will be allowed to count the marks gained in any subject, unless those marks shall at least amount to one-sixth of the total number of marks allotted to that subject.

Every candidate must transmit to the War Department, Pall Mall, by the 20th June next:—

1st. An extract from the register of his baptism, or, in default of that, a certificate verified by affidavit.

2nd. A certificate of good moral character, signed by a clergyman of the parish to which he belongs, and by the tutor or head of the school or college at which he has received his education for at least two years, or such other proof of good moral character as will be satisfactory to the Secretary of State.

3rd. A statement of the subjects of examination in which (in addition to pure mathematics) he may desire to be examined.

All candidates must present themselves at King's College on Monday the 30th of June, at one o'clock P.M., where they will severally be inspected by Military Surgeons, in order to ascertain that they are free from any bodily defects or ailments calculated to interfere with the performance of military duties.

H. R. Drewry.

War Department, Pall Mall, 19th May 1856.

D.

Prospectus of the next Examination for Admission to the Royal Military Academy at Woolwich.

N.B.—No more direct Appointments will be made to Provisional Commissions in the Royal Artillery.

An Examination for the admission of Cadets to the Royal Military Academy at Woolwich will be held in London in the month of June 1857.

Provided a sufficient number are found competent, thirty admissions will be made to that Institution; candidates must be between the ages of seventeen and twenty years. Those, however, who have not exceeded twenty years of age on the 1st January next, will not be considered disqualified. The successful candidates will remain under instruction until they are sufficiently advanced in scientific knowledge to pass a satisfactory examination, and they will then receive Commissions in the Royal Artillery or Royal Engineers. They will be required to pay a sum of 22*l.* 10*s.* on admission, to cover the

expense of uniform, books, &c., and a contribution of 62*l.* 10*s.* for each half-year of the time during which they remain at the Academy. The half-yearly contributions, however, for sons and orphans of naval and military officers, will be regulated at the following rates, as heretofore :—

For sons of Admirals and of Generals having Regiments	£40
Sons of Generals without Regiments	35
Sons of Captains and Commanders of the Navy, and of Colonels and Regimental Field Officers of the Army	30
Sons of all Officers of the Navy and Army under the above ranks	20
Sons of Officers of the Army and Navy who have died in the Service, and whose families are proved to be left in pecuniary distress	10

The sons of General Officers paid only on their Commissions as Field Officers, will pay the same contribution as the sons of Field Officers.

The sons of Officers on full and half-pay will pay alike ; but the sons of Officers who have voluntarily retired on half-pay, *or received the difference*, will only be admitted on the terms prescribed for the sons of private gentlemen, viz.—62*l.* 10*s.* for each half-year.

The sons of Officers of the Civil Departments of the Army are admissible to the Academy, upon the same terms as those prescribed for the sons of Naval and Military Officers.

The admissions will be determined by the result of a competitive examination, the subjects of which will be as follows :—

	Marks.
Pure and Mixed Mathematics, *i.e.*, Statics, Dynamics, and Hydrostatics	3,500
English Language, Literature, Composition, History, and Geography	1,250
Language, Literature, Geography, and History of Ancient Rome and of Ancient Greece	1,750
Ditto ditto ditto of France	1,000
Ditto ditto ditto of Germany	750
(The examination in French and German will be both written and *vivâ voce*.)	
Experimental Sciences, *i.e.*, Chemistry, Heat, Electricity, including Magnetism	1,000
Natural Sciences, Mineralogy, and Geology	750
Moral and Political Sciences	1,000
Drawing, *i.e.*, Elementary Geometrical Drawing, including the use of Drawing Instruments, and either Machinery, Architectural, Engineering, or Landscape Drawing	1,000

No candidate will be allowed to be examined in more than five subjects, of which one must be Mathematics, and no one who does not obtain at least one-fifth of the allotted number of marks in this subject will be eligible for an appointment.

From the other subjects of examination each candidate may select those in which he desires to be examined ; but no one will be allowed to count the marks gained in any subject, unless those marks shall at least amount to one-sixth of the total number of marks allotted to that subject.

No candidate will be admitted into the Royal Military Academy unless he obtain an aggregate of 3,000 marks at least.

Any candidate who shall not select French and Drawing among the subjects for his examination, will be required to satisfy the Examiners that he has such knowledge, at least of the elements of those two subjects, as shall afford reasonable expectation that he will perfect himself in both during his residence at the Academy.

The following papers will be required to be transmitted by each gentleman to the War Department, before the 1st June, with his application to be noted as a candidate, unless he shall notify that he has been a candidate at a previous examination, in which case the statement of subjects only need accompany the application :—

1st. An extract from the register of his baptism, or, in default of that, a certificate verified by affidavit.

2nd. A certificate of good moral character, signed by a clergyman of the parish to which he belongs, and by the tutor or head of the school or college at which he has received his education for at least two years, or such other proof of good moral character as will be satisfactory to the Secretary of State.

3rd. A statement of the subjects of examination in which (in addition to Mathematics) he may desire to be examined.

All candidates will be required to present themselves at the place of examination hereafter to be determined, in order to be inspected by Military Surgeons, that it may be ascertained that they are free from any bodily defects or ailments calculated to interfere with the performance of military duties.

Notice will be given a month previously, in the public papers, of the place and days appointed for holding the examination.

War Department, Pall Mall, 14th November 1856. H. R. DREWRY.

Annex 3.

Annual Vote for Woolwich Academy to the Year 1831.

	£	s.	d.	
1741 to 1770 - - -	1,000	0	0	
1771 „ 1772 - - -	1,364	14	0	
1773 „ 1775 - - -	1,594	5	0	
1776 „ 1782 - - -	1,644	5	0	
1783 - - - -	1,744	5	0	
1784 „ 1788 - - -	1,844	14	0	
1789 „ 1797 - - -	2,327	15	0	
1798 - - - -	2,527	15	0	
1799 „ 1802 - - -	3,151	14	9	
1803 „ 1804 - - -	4,144	14	9	
1805 - - - -	4,133	18	0	
1806 - - - -	4,143	18	1	
1807 „ 1808 - - -	6,050	15	5	
1809 - - - -	6,528	8	4	
1810 - - - -	6,547	12	0	
1811 „ 1812 - - -	6,645	4	2	
1813 - - - -	6,786	2	1	
1814 - - - -	6,846	7	6	
1815 - - - -	7,314	12	3	
1816 - - - -	7,443	7	3	
1817 - - - -	7,326	16	3	
1818 - - - -	7,314	12	3	
1819 - - - -	7,578	10	3	
1820 - - - -	7,789	6	7	
1821 - - - -	6,610	9	1	
1822 „ 1823 - - -	5,707	3	0	
1824 - - - -	4,570	0	0	(including 353*l.* for Officers of the Cadet Company.)
1825 - - - -	4,407	0	0	(and a contingency of 1,286*l.*)
1826 - - - -	4,313	0	0	(and the same contingency.)
1827 „ 1828 - - -	4,045	0	0	(and the same contingency.)
1829 - - - -	3,507	0	0	
1830 „ 1831 - - -	3,402	0	0	

Annex 4.

A.

Vote continued, and Annual Contributions of Cadets.

	Vote continued. £	s.	d.	Annual Contributions. £	s.	d.	Surplus Receipts. £	s.	d.
1832 (year ending 31st March) -	1,000	0	0	1,476	0	0	nil.		
1833 „ „ -	nil.			4,500	0	0	634	0	0
1834 and 1835 „ -	nil.			6,000	0	0	(1834) 2,134 (1835) 2,207	0 0	0 0
1836 and 1837 „ -	nil.			6,500	0	0	(1836) 2,720 (1837) 2,158	0 0	0 0
1838 „ „ -	nil.			7,000	0	0	2,657	0	0
1839 „ „ -	nil.			8,400	0	0	2,534	0	0
1840 „ „ -	nil.			8,160	0	0	2,185	0	0
1841 „ „ -	nil.			9,960	0	0	3,283	0	0
1842 „ „ -	1,496	0	0	14,585	0	0	—		
1843 „ „ -	1,262	0	0	16,525	0	0	—		
1844 „ „ -	428	0	0	16,835	0	0	—		
1845 „ „ -	200	0	0	18,503	0	0	—		

The Receipts in the subsequent years will be found below in Table B.

B.

STATEMENT showing the Annual Receipts and Expenditure on account of the Royal Military Academy at Woolwich and Junior Establishment at Carshalton, from 1846 to 1855 (31st March).

—	Woolwich.						Carshalton.					
	Receipts.			Expenditure.			Receipts.			Expenditure.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1846	18,057	12	3	18,567	0	5	—			—		
1847	19,433	1	11	18,751	16	2	—			—		
1848	19,068	16	8	19,391	18	5	—			—		
1849	18,426	0	0	19,578	18	8	—			2,772	13	4
1850	19,315	0	0	19,863	18	2	8,215	0	0	4,611	4	1
1851	19,476	12	10	20,608	8	1	8,720	0	0	4,429	14	11
1852	18,008	18	6	19,667	19	2	6,553	12	6	4,492	5	6
1853	16,858	16	1	19,401	12	4	6,197	2	10	4,752	4	3
1854	17,228	16	9	20,595	18	8	6,775	0	0	4,989	15	0
1855	19,484	11	7	22,321	14	11	6,322	18	4	5,134	17	7
Totals -	185,358	6	7	198,749	7	0	42,783	13	8	31,182	14	8

	Expenditure.			Receipts.		
	£	s.	d.	£	s.	d.
Woolwich - - - - -	198,749	7	0	185,358	6	7
Carshalton - - - - -	31,182	14	8	42,783	13	8
Total Expenditure - - -	229,932	1	8	228,142	0	3
Receipts - - - - -	228,142	0	3			
Balance in 10 years against receipts -	1,790	1	5			

C.

STATEMENT showing the Annual Receipts and Expenditure on account of the Royal Military College at Sandhurst from 1846 to 1855.

Year.	Receipts.			Expenditure.		
	£	s.	d.	£	s.	d.
1845 and 1846	16,385	8	8	16,793	12	8
1847	17,664	10	3	17,535	18	9
1848	17,624	10	3	17,939	14	0
1849	26,124	17	10	21,408	12	2
1850	18,110	7	7	18,956	9	3
1851	18,761	5	4	18,067	15	6
1852	19,116	2	10	16,494	14	11
1853	17,905	5	2	16,770	6	0
1854	17,917	2	8	17,424	14	1
1855	17,819	17	8	18,070	6	11
Totals -	187,429	8	3	179,462	4	3

	£	s.	d.
Receipt - - - - - - -	187,429	8	3
Expenditure - - - - - - -	179,462	4	3
Balance in 10 years in favour of receipts -	7,967	4	0

EVIDENCE OF ENGLISH OFFICERS.

QUESTIONS ADDRESSED TO ENGLISH OFFICERS.

LETTER OF THE 11TH MARCH, REFERRED TO IN THE REPORT, PAGE iii.

SIR, Metz, March 11, 1856.

THE Commissioners appointed by the Secretary of State for War to consider the best mode of re-organising the system of training Officers for the Scientific Corps have been directed to circulate questions on the subject-matter of their inquiry among such persons as are likely to be able to assist them by their knowledge and abilities.

They beg, therefore, to request your attention to the accompanying questions. In answering these, your experience will materially further the objects of the Commission by showing them what facilities are at present given to Officers, previous to entering the Army, immediately after entrance, and during the course of their service, for attaining the scientific knowledge required for the discharge of their duties; and the Commission also hopes that you will assist them by suggesting any measures which may seem to you calculated to render the existing education still more efficient.

The Commission would be glad to receive any answers to these questions at any time before the 25th of April next. They should be addressed to "The Commission for Reporting on the Education of the Scientific Corps, War Department, Pall Mall."

I have the honour to be,
Sir,
Your obedient Servant,
A. H. CLOUGH, *Secretary.*

N.B.—A copy of this letter was sent to each Officer to whom the following questions were addressed.

I.

GENERAL QUESTIONS.

1. Will you have the goodness to supply the Commission with an account, n as much detail as you think fit, of the usual duties belonging to Officers in the Artillery, *or* in the Engineers,* in time of war and of peace, at home and on foreign service, which must be considered in reference to their education?

2. Can you give an idea of the average number of Officers in the Artillery, *or* in the Engineers,* employed on duties of a not strictly Military character?

3. In reference to question No. 2, do you think that all these duties should be considered, or that any of them should be omitted from consideration, in the instruction given to Officers of the Artillery, *or* of the Engineers?

Addressed to

General Sir HEW D. ROSS, G.C.B., R.A., Adjutant-General of the Royal Artillery,

Colonel PALLISER, R.A., Assistant Adjutant-General of the Royal Artillery, Woolwich;

And to

General Sir JOHN F. BURGOYNE, Bart., G.C.B., R.E., Inspector-General of Fortifications,

Colonel MATSON, R.E., Deputy Adjutant-General to the Royal Engineers.

II.

THE SAME CONTINUED.

4. What instruction, or assistance in their professional studies, is at present supplied to Officers in the Artillery, *or* in the Engineers,* after joining their respective Corps?

5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

6. Does any institution for Officers in the Artillery, similar to the Senior Department at Sandhurst, appear to you to be desirable?

7. Could any addition be advantageously made to the duties at present

* The answer to be given in reference to the Corps to which you belong.

assigned to Officers in the Artillery, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

8. Do you consider that any re-adjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as officers? For instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected, as now determined on, by means of a public competitive examination,) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

Addressed to

General Sir Howard Douglas, Bart., G.C.B., G.C.M.G., formerly of the Royal Artillery,
General Sir Hew D. Ross, G.C.B., R.A.,
Major-General W. B. Dundas, C.B., from R.A.,
Major-General Chesney, from R.A.,
Major-General Sabine, from R.A.,
Colonel Pallisser, R.A.,
Colonel Tulloch, R.A.,
Colonel St. George, C.B., R.A.,
Lieut.-Colonel Wilmot, R.A., Superintendent of Royal Gun Factories, and formerly Second Captain Commanding Cadet Company,
Lieut.-Colonel Barker, C.B., R.A.,
Lieut.-Colonel Gardner, R.A.,
Lieut.-Col. Strange, C.B., R.A.,
Major Charters, R.A.,
Captain Younghusband, R.A., Secretary to the Royal Artillery Institution,
Captain Boxer, R.A., Superintendent of Royal Laboratories, and formerly Instructor in Practical Artillery,
Lieut. Blakeston, R.A.;

And to

General Sir J. F. Burgoyne, Bart., G.C.B., R.E., Inspector-General of Fortifications.
Major-General Harding, C.B., from R.E.,
Colonel Matson, R.E.,
Colonel Portlock, R.E., Inspector of Studies at the Royal Military Academy,
Lieut. Colonel Larcom, R.E.,
Lieut.-Colonel Burgmann, R.E.,
Lieut.-Colonel James, R.E.,
Lieut.-Colonel Harness, R.E., formerly Professor of Fortification at the Royal Military Academy, and afterwards Superintendent of Surveying and Practical Astronomy at Chatham.
Lieut.-Colonel Simmons, R.E.,
Captain Cameron, R.E.,
Captain Galton, R.E.,
Major Du Cane, R.E., superintending the Instruction in the Electric, Magneto-Electric and other Field Telegraphs at Chatham,
Captain Scott, R.E., Superintendent of Surveying, Practical Astronomy, Chemistry, and Civil Works, and of the Halls of Study, at Chatham,
Lieutenant Cowell, R.E.

III.

To Officers who have served in the Crimea.

10. As the results of your observations in the Crimea would you say that in any points of practical or scientific knowledge, the education of the Officers of the Artillery *or* Engineers,* as at present conducted, is susceptible of improvement.

11. Can you make any suggestions with this view for the improvement of the teaching now given at the Academy at Woolwich?

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* The answer to be given in reference to the Corps to which you belong.

Addressed to

Major-General Sir R. J. Dacres, K.C.B , from R.A.,
Colonel St. George, C.B., R.A.,
Lieut.-Colonel Taylor, R.A. ;

And to

General Sir J. F. Burgoyne, Bart., G.C.B., R.E.,
Major-General Sir Harry D. Jones, K.C.B., from R.E., Governor of the Royal Military College, Sandhurst, and formerly Director of the Royal Engineer Establishment, Chatham.
Colonel J. W. Gordon, C.B., R E.

IV.

Relating to the Establishment of Field Instruction at Chatham.

12. Will you have the goodness to inform the Commission with regard to the establishment for field instruction at Chatham ; 1st, of the causes and circumstances which led to its being set on foot ; 2nd, of the principal changes which have been made from time to time in the instruction ; 3rd, of the corresponding changes in the staff and establishment ; 4th, of the nature of the instruction ordinarily afforded, previous to the late sudden demand for officers ; 5th, of the number of officers, under ordinary circumstances, receiving instruction at the institution ; 6th, of the number and functions of the persons engaged in superintending and communicating instruction ; and, 7th, of the amount of the total annual expense of the institution ?

Addressed to

Colonel Sandham, R.E., Director of the Royal Engineer Establishment, Chatham.

V.

The Same continued.

13. What, in your opinion, is the amount of mathematical knowledge which, according to the usual system (as pursued prior to the war), is requisite for passing with advantage through the course of study followed at Chatham ?

14. Do you consider that Officers are sufficiently instructed when they join at Chatham, either as regards the extent or the depth and accuracy of their knowledge, to enable them to follow the course with full advantage ?

15. Are there any subjects, not at present taught at Chatham, which you think should be added to the course ? or can you suggest any improvement in the general mode of instruction pursued ?

16. In case of such improvements being effected, what additional amount of previous mathematical knowledge would become requisite ?

17. Without reference to what may be the present state of teaching, what do you consider to be the education, both scientific and practical, which would most completely qualify an Officer of the Engineers for the discharge of his various duties.

Addressed to

Major-General Sir J. M. F. Smith, K.H., from R.E., formerly Director of the Royal Engineer Establishment, Chatham,
Major-General Sir Harry D. Jones, K.C.B., from R.E., Governor of the Royal Military College, Sandhurst, and formerly Director of the Royal Engineer Establishment, Chatham,
Colonel Sandham, R.E., Director of the Royal Engineer Establishment, Chatham,
Lieut.-Colonel M'Kerlie, R.E., formerly Superintendent in Surveying and Practical Astronomy at Chatham,
Captain Scott, R.E., Superintendent of Surveying, Practical Astronomy, Chemistry, and Civil Works, and of the Halls of Study, at Chatham.

VI.

Relating to Instructions given to Artillery Officers immediately on joining their Regiment at Woolwich.

18. Will you have the goodness to inform the Commission of the nature of the instruction that has been afforded to young Officers of the Artillery imme-

diately on joining their regiment at Woolwich, and of the causes and circumstances which led to its being given?

19. Will you state whether it is still given, and if not, under what circumstances it has ceased to be so?

20. What was the usual amount of mathematical knowledge possessed by Officers on joining this course, during your connexion with it?

21. What in your opinion is the proper amount of mathematical knowledge which should be possessed by a young Officer on joining the regiment?

22. Without reference to what may be the present state of teaching, what do you consider the education, both scientific and practical, which would most completely qualify an Officer of the Artillery for the discharge of his various duties?

Addressed to

Colonel Wilford, R.A., Director of Artillery Studies at Woolwich,*
Lieut.-Colonel Wilmot, R.A., Superintendent of Royal Gun Factories, and formerly Second Captain Commanding Cadet Company,
Lieut.-Colonel Dixon, R.A. successively Cadet Officer, R.M.A., Instructor in Practical Artillery, and Director of Artillery Studies,
Major Charters, R.A.

VII.

Relating to the Royal Military Academy at Woolwich.

23. Have any alterations, in the course of studies, of arrangement of hours been made, since the issue of the printed Regulations bearing the date the 18th of August 1848?

24. Will you have the goodness to furnish the Commission with a tabular statement of the average number of Cadets in the Institution for every year since 1800, showing their average ages at the date of their admission, and at that of their receiving their commissions? Will you at the same time state the number who have annually obtained commissions in the Artillery and in the Engineers respectively, the strength of the two Corps, as authorized by the Warrant, and their absolute strength, for each year of the same period?

25. Will you also furnish the Commission with a return of the number of Cadets annually removed from the Academy on account of incapacity during the last fifteen years, specifying the length of their residence before their removal, and stating, as far as you can, the nature of the deficiencies that occasioned it?

26. Will you have the goodness to supply the following details of the last examinations, both in the theoretical and in the practical class, of the Cadets (numbers being substituted for their names) who were respectively commissioned in the years 1847 and 1852; viz., 1st, copies of the examination papers with the questions consecutively numbered in one series; 2nd, a statement of the credits each Cadet should have obtained in each branch of study, together with the credits actually obtained, marking by the numbers of the series mentioned above the questions answered by each; 3rd, a statement of their respective ages at the date of their admission, and of the actual amount of time during which they received instruction in the theoretical and in the practical class?

27. Will you also supply the Commission with a list of the various studies followed at the Academy prior to the commencement of the war, together with a detailed account of the Officers, Professors, and Masters attached to the establishment for enforcing general discipline, and for carrying on the instruction? How is the discipline maintained during the hours of study?

28. Can you inform us of the number of Cadets, who, during the last fifteen years, have passed through the theoretical class in the course of two years? can you state their ages at the date of their admission to the Academy, and the extent of their mathematical knowledge when they joined and when they quitted?

29. Will you furnish the Commission with a return showing the relative positions, at their last examinations, of the Officers who have selected the Artillery, and of those who have selected the Engineers during the last fifteen years?

Addressed to

Major-General Lewis, C.B., from R.E., Lieut.-Governor of the Royal Military Academy.

* Since appointed Governor of the Royal Military Academy, Woolwich.

VIII.

THE SAME CONTINUED.

31. Referring to the list of Officers, Professors, and Masters attached to the Academy, will you state whether you consider that there is or is not an insufficient amount of instruction afforded at the Academy? And will you particularize any branches of study, which in your opinion should be added to, or taken from the existing course?

31. Is there, in your opinion, any deficiency in the staff of Professors and Masters at the Academy?

Addressed to

Major-General LEWIS, C.B., from R.E., Lieut.-Governor of the Royal Military Academy,
Major-General W. D. JONES, from R.A., formerly Inspector of Studies at the Royal Military Academy,
Colonel PORTLOCK, R.E., Inspector of Studies at the Royal Military Academy,
Colonel WILFORD, R.A., Director of Artillery Studies at Woolwich,
Lieut.-Colonel ELWYN, R.A., Assistant Inspector of Studies at the Royal Military Academy,*
J. J. SYLVESTER, Esq^re^, Professor of Mathematics at the Royal Military Academy,
Captain BAINBRIGGE, R.E., Professor of Fortification at the Royal Military Academy.

IX.

THE SAME CONTINUED.

32. Have there been difficulties at any time in the removal of offenders, or in enforcing a sufficiently strict system of discipline at the Academy? If so will you mention any occasions, on which you have reason to believe that this has been the case, and will you state what you consider to have been the cause?

Addressed to

Major-General LEWIS, C.B., from R.E., Lieut.-Governor of the Royal Military Academy,
Major-General W. D. JONES, R.A., formerly Inspector of Studies, Royal Military Academy,
Colonel PORTLOCK, R.E., Inspector of Studies, Royal Military Academy,
Lieut.-Colonel WILMOT, R.A., Superintendent of Royal Gun Factories, and formerly Second Captain Commanding Cadet Company,
Lieut.-Colonel ELWYN, R.A., Assistant Inspector of Studies at the Royal Military Academy,*
Captain SHAKESPEAR, R.A. Officer Commanding Cadet Company.

X.

THE SAME CONTINUED.

33. Have any persons, or has any person, been hitherto entrusted with the duty of making representations as to existing defects or the possibility of improvements in the Academy? If so, to whom would such representations be addressed.

34. Have any representations been made during the last fifteen years to the Lieut.-Governor by Officers or Professors, or by the Lieut.-Governor or others to the Master-General of the Ordnance, as to any insufficiency in the instruction afforded at the Academy? And if so, what have been the steps taken to inquire into such representations, and to remedy the defects pointed out, or make the improvements suggested.

Addressed to

Major-General LEWIS, C.B., from R.E., Lieut.-Governor of the Royal Military Academy,
Major-General W. D. JONES, R.A., formerly Inspector of Studies at the Royal Military Academy,
Colonel PORTLOCK, R.E., Inspector of Studies at the Royal Military Academy.

* Now Inspector of Studies, *vice* Colonel Portlock, resigned.

EVIDENCE OF ENGLISH OFFICERS.

General Sir HowardDouglas, Bart., G.C.B., &c.

From General Sir Howard Douglas, Bart., G.C.B., G.C.M.G., formerly of the Royal Artillery.

Gentlemen, 15, Green Street, May 8, 1856.

Adverting to the foot-note inserted at the bottom of the paper containing the questions which you have propounded to me, it appears that you do so under the impression that I belong to one of the Scientific Corps to which those questions relate. This is not so. I left the Royal Artillery in 1804, promoted for a particular service into a Regiment of the Line; and having had no organic connexion with those Scientific Corps since that remote period, I might perhaps be excused were I to decline answering the questions you have submitted to me, on the grounds of incompetency to give the information you desire from me on educational subjects connected with the Ordnance, with which I have long ceased to be specially concerned.

But having, with a strong sense of what I owe to the admirable school, the Royal Military Academy, in which I was educated, and to the distinguished Corps in which I commenced and prosecuted for ten years my career, continued to devote myself to the acquirement and cultivation of military science in general, and having been a good deal connected with the other educational establishments of the Army, I hold myself bound to answer, as well as I can, the questions you have propounded to me, and which I have only to regret may not be so useful to the public service as I should desire, and as you possibly may expect.

Limited character of the instruction afforded after joining;

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Artillery after joining their respective Corps?

There is no instruction or assistance whatever in Mathematics, Fortification, or Military Tactics, for Officers after having joined the Regiment or Corps. But Artillery Officers attend a laboratory course at Woolwich; and they, as well as Officers of the Engineers, may attend any experiments which are carried on at Woolwich or elsewhere.

necessity of its extension.

Question 5. Would it be possible, and if possible desirable, to have further instruction given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

Further instruction would be possible and desirable; it is even necessary, if the school education at Woolwich is to be rendered available, as far as it might be, for the public service. Most young men, after joining the Regiment or Corps, neglect to keep up the knowledge they have acquired at the Academy, and thus are incapable of applying it to useful purposes. The few Officers of Artillery and Engineers who have distinguished themselves in the scientific world are bright exceptions.

Additional studies, Mathematics, Dynamics, &c., Tactics, Military History, French and German, Construction of Machinery, Chemistry, Artillery Tactics.

Officers of both branches require a greater amount of mathematics than can be communicated to them during their cadetship. Supposing them to retain all the elementary mathematics which they have acquired then, they need the higher branches of dynamics and hydrodynamics, the knowledge of tactics, with military history, and a more perfect knowledge of the French and German languages. These subjects might be acquired at Woolwich under Professors and Masters. More practical knowledge is required respecting the strength of materials and the construction of machinery. Artillery Officers require a more complete knowledge of chemistry, the tactics of artillery in the field, &c. These subjects would require Professors and Instructors, and might be obtained at the Academy, at the Arsenal, and in the Dock Yard.

The Artillery and Engineering Services should be combined with those of a General Staff, by adequate attainments on the part of the Officers in the study of military topography and general tactics.

In my evidence before the Committee (Arts. 2326–2334),* and in my Appendix, pp. 178–188, I have entered at considerable length into the subject of

* *See* Report from the Select Committee on Sandhurst Royal Military College, pp. 162 to 164, and Appendix.

GENERAL SIR HOWARD DOUGLAS, BART., G.C.B., &c.

Military education on the Continent, and I have fully described the courses of study pursued by the students at the general and special schools, with the nature of the examinations at their entrance and at their final departure, when the studies of the pupils are completed.

Continental Schools.

The curriculum of Military education in this country would be much improved if it were assimilated to those which are pursued at St. Cyr, and at the Ecole d'Application d'Etat Major, to the programs of which I referred, at some length in my evidence given before the Committee of the House of Commons; but these programs not having been printed in the Appendix to the Report of that Committee, I have the honour to transmit, herewith, copies of them brought up to the present time according to the latest regulations, and to request that these should be printed as an *annex* to the present paper, on the ground of the aid which they may afford in forming a scale of education for Officers of the Scientific Corps in the British Service.

The regulations respecting the services of the three arms in this country being very different from those adopted on the Continent, the plan of Military education cannot be precisely the same here as abroad; but the schools of Germany, Prussia and Belgium, being formed nearly on the model of those in France, it may be considered that in England the Military seminaries ought to correspond as nearly as possible to those in France. The French plan is in favour of making the education of Officers for the Artillery, the Engineers, and even for the General Staff (Answer to Question 2,350) identical, excepting only the mechanical details of the Artillery service, and those parts of Military architecture which have no relation to that branch; these must necessarily be distinct from one another.

Sandhurst to become a General Elementary College for all Arms.

The entire subject of Military education should be revised and made to accord with the present organization of the army. As it is highly advantageous that all the branches of the Military service should be under the Commander-in-Chief instead of being divided between that high Officer and the Master-General of the Ordnance, so the educational establishments of the Army should be under one head, which may also be the Commander-in-Chief. Sandhurst might be made a general elementary institution for youths intended to become Officers in all arms of the service. Selections might be made from these youths for the Line, the Artillery, the Engineers, and the General Staff, according to their tastes, their talents, and their qualifications; the two last being tested by a good system of examinations. A senior department consisting of élèves selected from those in the General Institution might be established at Woolwich, or elsewhere, as a special school for the Artillery, the Engineers, and the General Staff, at which the higher branches of science might be taught. The courses for practical instruction only for the three classes of Officers must be distinct (though all three classes ought to participate in the three courses in different degrees). The course of practical instruction in Artillery may be carried on at Woolwich; the course in Engineering may be at Chatham, and the course in Topography at Sandhurst, or wherever there may be ground favourable for instruction in Military surveying.

Special School for Artillery, Engineers, and Staff at Woolwich, or elsewhere.

Practical courses, in Artillery at Woolwich, in Engineering at Chatham, in Topography at Sandhurst.

Senior department for Artillery and Engineers indispensable.

Question 6. Does any institution for Officers in the Artillery, similar to the Senior Department at Sandhurst, appear to you to be desirable?

A Senior Department for Officers of the Artillery and Engineers is indispensable, that the higher courses of study in mathematics, languages, &c., may be taught.

A Senior Department for Officers of Artillery and Engineers and the Senior Department at Sandhurst might be embodied in one institution, though this is not essential. The studies of these three classes of Officers should be the same in pure mathematics, in fortification, in the tactics of the three arms, in military topography, and languages, though the different classes may not study each of these three branches to the same extent. In mechanical details the three classes have different objects of study.

Duties during peace. Artillery Officers to accompany marches of troops with artillery.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Artillery in time of peace of a nature to continue and extend the scientific studies requisite for the

I can think of nothing in answer to this question, but that it may be part of the duty of Artillery Officers to accompany bodies of troops with artillery, in marches along roads, over pontoon or other bridges, and through defiles, to

General Sir Howard Douglas, Bart., G.C.B., &c.

efficient performance of their duties in time of war?

Artillery might be combined with Engineers in the construction of barracks, casements, and batteries.

Question 8. Do you consider that any re-adjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers; for instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

place batteries in position on ground. Such duties would be illustrative of the tactics of Artillery, the lectures on which the Officers should attend for the theory.

A combination of the Corps of Artillery and of Engineers would be advantageous, as far as both Corps are concerned, in the building of barracks and casemates, and in the construction of field batteries during the siege of a fortress; in other respects, the duties of Officers in the two Corps are widely different. The theoretical studies for Officers of both Corps are the same.

The theoretical studies are the same.

One year at a Military College.

Studies to be pursued there.

Question 9. Do you think it would be more advantageous to the public service that the Officers of the Artillery and Engineers should, after being selected as now determined on, by means of a public competitive examination, proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties; or would you suggest any other plan?

There would be an advantage in sending the Officers selected for the Artillery and Engineers to a Military College (probably one year would suffice). The mathematical knowledge of Officers so selected is presumed to be already considerable; but they should study more profoundly those parts of the course which relate to Military topography, Military history, &c., and they should be as perfect as possible in the French and German languages.

I have, &c.
(Signed) Howard Douglas.

The Commissioners for reporting on the
Education of the Scientific Corps of the Army.

Abridged Account of the Ecole Speciale Militaire at St. Cyr, and of the Ecole d'Application d'Etat Major.—By General Sir Howard Douglas, Bart., &c., &c.

Ecole Spéciale Militaire, St. Cyr.

This School forms Officers of Infantry and Cavalry, and Officers for the *Ecole d'Application d'Etat Major.* Some of the candidates for admission are taken from the *Prytanée Militaire*, and the ages for admission are from sixteen to twenty, but corporals and private soldiers who have served two years are admitted to compete from twenty to twenty-five years of age. The admission of pupils is by competition, and the course of instruction continues during two years. The entrance examination is partly oral, and partly by writing. Previous to the entrance examination the candidate gives in written compositions and drawings, viz.:—(1.) A description of some kind in the French language. (2.) Solution of a question in plane trigonometry, requiring the employment of logarithms and a diagram of a problem from Euclid. (3.) A paragraph written in German. (4.) A drawing from a bust, shaded.

The subjects of the entrance examination are:—

1. *Arithmetic*, with logarithms, an easy example being worked.
2. *Algebra*, an easy example, an equation of the second degree, progression and interest.
3. *Geometry.* Problems and theorems of Euclid enunciated; the diagrams of the problems executed.
4. *Plane Trigonometry.* Rules enunciated, and easy examples worked.
5. *Applied Mathematics.* Geometry on the ground problems; station problems executed geometrically; three drawings of ornaments executed; six geometrical figures drawn; two plans of ground in outline; two plans of ground coloured; four drawings of projections; four plans, elevations, and sections of buildings. The candidates answer questions on these drawings.
6. *Cosmography.* Names of planets; projections of the sphere; tides; lengths of the tropical and sidereal years, &c.

7. *Natural Philosophy.* Equilibrium of fluids; hydrostatic press described; densities of solids and liquids; barometers; ballons; draught of chimnies; latent heat; radiant heat; electricity; magnetism; reflection and retraction of light, telescopes, &c.
8. *Chemistry.* Cohesion; affinity; gases, &c., described.
9. *History.*
10. *Geography.*
11. *German Language.*

Compensations for failures not admitted.

Programme of the First Year's Studies.

Descriptive Geometry (Thirty Lessons).

Projection of a line on a plane; projection of a plane passing through three given points; projection of a plane passing through a given point, and parallel to a given plane; representations of cylindrical and conical surfaces; a tangent plane drawn to a solid of revolution; projections of *surfaces gauches* and *surfaces developpables;* properties of conic sections; on perspective and on shadows; constructions of maps, geography, contoured plans, &c.

Physical Science (thirty-five Lessons). Chemistry; electricity; magnetism; gases; metallurgy; mechanics applied to machines; composition, &c. of forces; collision of bodies; simple machines; pumps; locomotives, &c.

Military Literature (twenty Lessons). Military history: accounts of battles, sieges, &c.; works of Vauban, Puysegur, &c.

General and Military History (thirty-five Lessons). Military correspondence; forms of letters; reports, &c.; *reconnaissances;* military journals, &c. The students compose memoirs relating to the subjects of the oral lessons; accounts of campaigns, expeditions, &c.

Statistical Geography (twenty-seven Lessons). Statistics of different nations, population, military force, &c.

Artillery (four Lessons). Description and use of fire-arms, cartridges, &c.

German Language (thirty Lessons).

Programme of the Second Year's Studies.

One study per week is devoted to improving the pupils in the rapid drawing of landscapes, &c. with pencil, pen, and brush.

Topography (ten Lessons). First part:—Definitions, scales, surveying instruments; plan of comparison; mamelon croupe; theory of instruments; manner of surveying with a plane table; levelling; measuring distances and angles; surveying by the eye; military and statistical information to be obtained on the ground. Second part:—Plans drawn and copied by scale. Third part:—The use of instruments taught within the walls of the school; a survey within 1,000 metres without the school, in two lessons of seven hours each, if possible; an irregular survey (qy. by the eye?) within two kilometres about the school, in one lesson of seven hours; a *reconnaissance* of route within three or four kilometres about the school, in four or six hours. The plans to be drawn directly after the survey.

Fortification (twenty-seven Lessons). Permanent and field fortification. The operations of a siege, gabions, facines, &c. are executed on the ground. Every year the students prepare one or two memoirs on the application of the subjects to practice.

Artillery (fifteen Lessons). Lectures on the parabolic theory; on the resistance of the air; problems relating to range, elevation, &c.; determination of a trajectory from experiment; mean trajectory; guns, mortars, portable arms; projectiles; pointing and firing; employment of artillery in sieges; in the field; military bridges; exercise of artillery.

Military Legislation (ten Lessons.) Natural law; laws of nations; forms of government; constitutions; constitution of an army; obedience essential in an army; an army cannot deliberate; its duties stated in laws; in war, commanders act on their own responsibility; importance of discipline; laws of recruiting; distribution of recruits in different regiments; ranks composing the military hierarchy; promotions; active service, and retirement of officers; retiring allowances; military tribunals; defence, judgment, appeals; sales of goods of deceased officers; military men cannot receive decorations from foreign sovereigns.

Military Administration (twelve Lessons). Economy of a company; pay, subsistence, &c.; dress, lodging, &c. (*Note.*—Pupils are employed in filling up printed forms relating to the administration of a company.)

Military History and Art (twenty-seven Lessons.) History of military institutions; composition of armies; secondary operations of war; history of remarkable campaigns: pupils write memoirs on remarkable campaigns, and on the attack and defence of houses, defiles, &c.; also memoirs and reports on the subject of their practical studies.

German Language (twenty Lessons.)

General Sir Howard Douglas, Bart., G.C.B., &c.

The Etat-Major and Ecole d'Application d'Etat Major.

The *corps d'Etat Major* now (1833) consists of 30 Colonels and 30 Lieutenant-colonels, 100 *Chefs d'Escadron*, 300 Captains, and 100 Lieutenants.

The *Ecole d'Application* consists of 50 pupils, who have the rank of Sous-lieutenants, of whom 25 are admitted annually. Of these, three are selected from the *Ecole Polytechnique*, and 22 from the *Ecole Spéciale Militaire* (St. Cyr,) or from Sous-lieutenants of the army, who have served at least one year. The age of a candidate must not exceed 25 years.

The pupils remain at the *Ecole d'Application* two years, and after the final examination, those who pass are admitted to the *corps d'Etat Major*, and perform the duties of Lieutenants as vacancies occur. Those who do not pass the examination go to the regiments of Cavalry or Infantry.

Captains of the army, of all arms, who have passed the examination on leaving the *Ecole d'Application*, may exchange with Officers of equal rank in the *corps d'Etat Major*; and Lieutenants or Captains of the *Etat Major* may retire to regiments of Cavalry or Infantry.

Lieutenants of the *Etat Major* are detached from the corps, and sent for two years to do duty in a regiment of Infantry, then for two years longer to do duty in a regiment of Cavalry, and subsequently, for one year in the corps of the Artillery or of the Engineers. During the first of the two years' service with Infantry or Cavalry those Officers serve in the regiments. In the second of the two years they may compete for the post of adjutant-major, and may perform the functions of such post. Lieutenants so detached from the corps of *d'Etat Major* can, in time of was only, be withdrawn from the regiments of Infantry or Cavalry till they have served the two years.

Officers of the *Etat Major*, from Captains to Colonels, may be employed as Aides-de-camp to Marshals of France or Generals commanding the *corps d'armée*, or as chief of the *Etat Major*. They may be attached to the *depôt de la Guerre* for the completion of the map of France and for other duties, and they may be employed as ambassadors in diplomatic missions.

Inspectors-General examine periodically the Lieutenants and Captains of the *Etat Major* in the theory of military manœuvres, &c.

Officers of the *Etat Major*, if not employed, may go on half-pay, or serve in regiments of Infantry or Cavalry.

The staff of the *Ecole d'Application d'Etat Major* consists of:—One General of Brigade, commanding; one Colonel, or Lieutenant-Colonel, Director of the studies; one *Chef d'Escadron*, Superintendent of the instruction and interior service of the school; three Captains, assistants of the *Chef d'Escadron* in military instruction and the evolutions of Infantry and Cavalry (these also superintend part of the topographical operations on the ground); one Physician; five Captains, military professors (one for Descriptive Geometry, one for Astronomy, Geography, &c., one for Geodesy and Topography, one for Fortification, one for instruction in Artillery); one Captain for the Military Art; one Sous-lieutenant for Military Legislation; two Captains *adjoints* for Descriptive Geometry, Fortification, and Topography; one Captain of Cavalry for instructions in that arm; one Lieutenant or Sous-Lieutenant of Cavaly as *adjoint;* two Civil Professors of Drawing; two ditto German language; one ditto Fencing; servants, &c. &c.

In the examinations. the relative merits of the candidates are determined by a scale of numbers, as follows:—

0 to 4, ignorance or deficiency; 5 to 9, middling or passable; 10 to 13, tolerably well; 14 to 18, well; 19 to 20, very well.

The *élèves* are classed in two divisions; and to pass from the second division to the first, the pupil must have 600 marks (half the maximum number).

In astronomy and descriptive geometry, six marks out of twenty; in other branches of theoretical instruction, four out of twenty; in geographical works eight of twenty. At the final examination, the *élève* must have 600 marks (half the maximum), otherwise he is inadmissible to the *corps d'Etat Major*.

The studies in the *Ecole* continue during eight months in each year; on the ground, three months; the examinations, one month. The daily attendance for each *élève* in the school is nine hours in winter and eleven hours in summer. No leave of absence is permitted; and during the hours of study no conversation, no receipt of letters, and no quitting the *salle d'étude* without leave are allowed.

Programme of the Subjects required for Admission.

Topography.—Measurement of a base; choice of triangles; calculation of the sides; the uses of surveying instruments; manner of representing ground; surveying by the eye; information to be obtained on the ground; formulæ of plane trigonometry; descriptive memoirs, &c.

Military History and Military Art.—History of military institutions; composition of an army; services of armies in the field; attack and defence of posts; reconnaissances; surprises; ambuscades; history of remarkable campaigns, &c., &c.; history of infantry, cavalry, and engineers.

General Sir Howard Douglas, Bart., G.C.B., &c.

Artillery.—Equation of a trajectory *in vacuo;* deviations; calculation of sights (*hausses*); manner of proving artillery; composition of batteries; ideas of the manœuvres of artillery, &c., &c.

Field Fortification.

Castrametation.

Permanent Fortification.—Systems of Vauban and Cormontaigne; operations of attack and defence of fortresses.

Military Legislation.—Pay, subsistence, clothing, &c., of troops.

Manœuvres.—For Sous-lieutenants of all arms; of a battalion of riflemen.

German Language.

One sitting is allowed for the composition of a memoir on some question relating to the military art; one ditto for a topographical plan relating to the subject of the memoir.

PROGRAMME OF THE COURSE OF INSTRUCTION.

(Qu. to pass from the first division to the second?)

Descriptive Geometry.—Shadows; perspective; dialling; architecture; machinery; measure of labour; wind and water-works; telegraphs, &c.; with drawings of a machine, a building, a perspective.

Astronomy, Geography, and Statistics.—Movements of the moon and planets; use of astronomical instruments; description of the earth; strategical lines in France; means of defending them; projections of maps; calculation of probabilities; use of tables of mortality; capital, money, banks, credit, &c., &c.; a memoir on a question in geography.

Topography.—Spherical trigonometry; Newton's binomial theorem; development of sines, cosines, &c. in series; optics; optical instruments; notions on analytical geometry; equations of lines; of the ellipse; tangents, &c.; problems relating to surveying; use of pantagrapher.

Geodesy.—Use of the repeating circle; calculations of triangles; manner of finding the latitudes and longitudes of stations; levelling by the barometer; plans relating to topography are drawn.

Artillery.—Construction of guns, carriages, &c.; of batteries; military bridges; buoyancy; armament of fortresses; field artillery; manœuvres of batteries.

Fortification.—Plans, &c., relating to fortification; attack and defence of places; designs for field forts, for military buildings, &c.; memoirs are written on the object of fortresses; description of fortresses; estimates of the strength of garrisons; quantities of ammunition, &c.

Military Legislation, and Administration of Armies.

Military Art.—Military systems of different countries; organization of armies; simultaneous employment of the three *arms;* lines of invasion; military positions; orders of battle; memoirs are written on military actions; on reconnaissances; on some particular campaign.

Manœuvres.—Of a battalion of infantry; of a regiment of cavalry.

HOWARD DOUGLAS.

REPLIES FROM OFFICERS OF THE ROYAL ARTILLERY.

General Sir Hew Ross, G.C.B., R.A.

From GENERAL SIR HEW D. ROSS, G.C.B., R.A., ADJUTANT-GENERAL OF THE ROYAL ARTILLERY.

SIR, Horse Guards, April 22, 1856.

IN reply to your letter dated 11th March, submitting for my consideration, by desire of the Commissioners on Education for the Scientific Corps, certain queries in regard to the facilities for obtaining the scientific knowledge required for the discharge of those duties at present given to Artillery Officers:—

1. Previous to entering the army;
2. Immediately after entrance;
3. During the course of their service.

I beg to observe, in regard to the first point, that there have been so many changes of late years in the system of the Academy, that I approach the subject with great diffidence; but that my opinions have invariably tended for the advantage of receiving boys into the Academy at a more advanced age than has generally been the practice, and that I have equally viewed the establishment of the Preparatory School at Carshalton for still younger boys as a great mistake in principle.

Age of admission to the Academy to be raised.

The experience, however, of those who have had the immediate charge of the Academy must have led them to a far better estimate than I can pretend to, of the advantages of the various systems.

I should regret, on the other hand, if under the new system of competition Officers were to receive their first Commissions at a more advanced age than

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nineteen to twenty. If would proportionally be to their disadvantage, and to that of the service, in attaining the higher grades.

Excellence of the Officers supplied by Woolwich to the Artillery.

Of one thing I can speak with confidence, that during the period that I have held the office of Adjutant-General, the Officers received into the Artillery from the Academy have generally, by their conduct, ability, and zeal in the performance of their duty, given the promise of high character, and of talent in their profession, and that the manner in which the various duties of the Officers of the regiment have been performed, and more especially since the breaking out of the late war, has proved their energy, ability, and soldierlike spirit. I may also remark, that whilst there has been a tendency to detract from the merits and scientific attainments of the Officers of Artillery, there never have been wanting, during my knowledge of the regiment, men suited to the occasion.

I am borne out in this assertion by a reference to the Officers who have held command in the field, and other responsible positions incidental to the war, and by the evidence of those Officers who have been suddenly called upon to fill the different situations as Heads of Departments, and who, under great pressure, by aid of the large means at their disposal, have succeeded in effecting improvements in mechanical and other sciences connected with their professions in the different departments, the want of which had long been recognized by their less fortunate predecessors, whom an unwise economy had deprived of the means to carry them out.

Thus much I have said to show that the education at the Academy (though I do not pretend to enter into the details of it) has not failed to produce good fruits; and with such modifications as mature consideration may suggest, it appears to me difficult to imagine an establishment more competent to its object.

I will now proceed to the second point.

Director of Artillery Studies.

At the period of the breaking out of the war, the young Officers, on being appointed to commissions in the Artillery from the Academy, joined at Woolwich, and were placed under a Director of Studies, whose duty it was to superintend and assist them in their professional pursuits. For this purpose a class-room had been provided in the Royal Artillery Institution, where for the first six weeks the Director had the entire control of their time and instruction to enable him to obtain such knowledge of their disposition, abilities, and attainments as would aid him in further direction of their studies. They were then permitted to enter upon the usual company duties, and also, at stated times to attend parades, artillery practice, riding schools, and those drills and exercises which were requisite to the due performance of their duties as officers; and which could be performed without trenching on the hours of study.

The studies comprised a course of reading and examination in military law, (Court-martial and Mutiny Act): military history, British and Foreign; treatises on artillery; treatises on fortification; reconnoitering and outpost duty; field sketching, and use of instruments; military bridging; application of the three arms; strategy, battles, and sieges; chemistry; mineralogy; military topography; military biography.

I was led to submit a proposal to Lord Anglesey for introducing this system, from a sense of the benefit to be derived from a closer supervision than formerly of the young Officers of Artillery joining at Woolwich from the Academy; the importance of such a measure having been increased by the enlarged temptations to idleness within the reach of the young Officers, since the opening of the railway from Woolwich to London.

This plan came into operation in 1850. The first Director of Artillery Studies having been sanctioned provisionally by Lord Anglesey as an experiment in the spring of that year. He had the disadvantages to contend with of limited means and of restricted accommodation allotted to his class in the barracks; but his success was so evident, that I was enabled before the close of the year to recommend that his appointment should be confirmed, with a suitable position and salary, which was accordingly done.

Travelling allowance.

In April 1853, there was an extension of the means of instruction by a grant from the Treasury of 400*l.* per annum, on the recommendation of Lord Raglan, to enable a proportion of the most intelligent of the young Officers under the Director of Studies, to visit the arsenals and fortresses on the Continent, and the manufacturing districts at home, and to obtain the advantage of French and German masters, who were, in addition, to afford instruction to Officers of Artillery of all ranks who might be desirous of profiting by it.

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In September 1853, the new Royal Artillery Institution was opened, including the excellent class-room already referred to for the class of young Officers, with a laboratory, drawing room, &c., for the general use of the Officers.

Royal Artillery Institution.

The liberality with which the requirements for the instruction of the young Officers had been met, and the success which had attended the labours of the successive Directors of Studies, seemed to leave little to be desired, when the necessities of the service in 1854, calling for the immediate active employment, at home or abroad, of all the junior Officers of Artillery, rendered it necessary to suspend the course of instruction.

Secretary to the Royal Artillery Institution.

The appointment of a Secretary to the Royal Artillery Institution, in 1853, shortly before the commencement of the war, would have proved, and must hereafter prove, a most useful auxiliary, as affording the means of reference and advice to such Officers as might be desirous of pursuing at the Institution, and at the out-stations, the particular subjects which might engage their interest and attention.

As regards the third point, the facilities within the reach of the general body of Artillery Officers, I am of opinion that the Royal Artillery Institution, with the powers of extension and correspondence through its Secretary, and with a system of detached professional libraries, which could easily be established at the out-stations, would afford the means of carrying on professional studies and improvement.

Question 1. Asking for an account of the usual duties of Officers in the Artillery in time of war and of peace, at home or on foreign service, which must be considered in reference to their education.

I shall now limit myself to a few observations on the wide field of discussion opened by the separate lists of questions. Adverting to the first of these lists, I feel it unnecessary for me to enlarge upon the various duties at home and abroad which devolve upon an Artillery Officer.

Present education suffices for the performance of professional duties.

Lieut.-Col. Smythe has served with his company at home and in the colonies, and must be fully conversant with these details. I may remark, generally, that an Officer who has been well grounded in the usual preparatory branches of Military Education, Mathematics, Languages, Drawing, and Fortification, with the practical knowledge which he is constantly acquiring, cannot fail to perform his Artillery duties in a satisfactory manner, both in peace and war, if possessed of ordinary intelligence and attention to his duties.

Further scientific attainments to be encouraged.

Admitting, however, that beyond what is essential to the due performance of his professional duties, the scientific attainments of an Officer must depend more upon the taste of the individual than upon the actual requirements of the service, it must ever be an advantage to the public service that such attainments should be encouraged; and the employment of well-qualified Artillery Officers, in common with the other branches of the service, upon the general staff of the Army, would greatly tend to enlarge their general knowledge, and would act as a stimulus to others to prepare for such employment.

Question 2. As to the average number of Officers in the Artillery employed on services of a not strictly military character.

Civil employments not beneficial to the service.

Generally speaking, I do not think that civil employments, which remove an Officer entirely from his professional duties, can be considered beneficial as it concerns his own branch of the service, especially if of long continuance, for not only during previous preparation, but also while holding that employment, his interest and attention are liable to be withdrawn from his profession, to which he would probably return without that zeal and alacrity so essential to the performance of those military duties which, from their less intellectual character, might appear to him distasteful.

As all Artillery Officers upon the establishment are necessarily required for the disciplining and duty of the corps, it is hardly necessary to say, that when employed apart from it they should be seconded or made supernumerary. I annex a memorandum of the Artillery Officers who are now so circumstanced.*

Question 6. Does any institution for Officers in the Artillery, similar to the Senior Department at Sandhurst, appear to you to be desirable?

Senior Department for Artillery and Engineers not desirable.

I have considered a question of a College or Senior Department, and I do not concur with those who advocate its being either necessary or desirable for the Artillery.

* *See* Table subjoined, p. 322.

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The standard of Artillery science must necessarily be maintained, while, as at present, a succession of Officers are constantly acquiring the highest scientific Artillery information in filling the offices of Instructors of the Cadets and of the Junior Officers and in the direction of the Civil Departments; and if the duration of such appointments be sufficiently limited, the theoretical and practical knowledge so acquired must be largely diffused throughout the Corps.

There could be but a limited number of Officers at a College, and the very large proportion of their brother Officers who would be doing their duty in the colonies and elsewhere would be naturally mortified if debarred from similar advantages,—a feeling which would not exist were the means of improvement felt to be in the reach of all.

An universal standard of scientific attainments of questionable desirability.

It may also be questioned whether much would be gained by an over-strained pursuit towards establishing an universal standard of scientific attainment among the Officers of Artillery, as, to render the Artillery efficient, the Officers should not only be theoretically scientific, but they should also take an interest in the discipline and instruction of the men of their companies; they should be able to control and command soldiers; they should themselves be of active habits; and encouragement should be given to those who, by their habits of outdoor pursuits, acquire the quickness of eye and knowledge of horses so indispensable to an Artillery Officer, and of which the value has been strikingly demonstrated by the efficiency of the troops and field batteries under the trying circumstances in which they have been placed in the Crimea.

Many of our most valuable Officers are of this class, and, with inferior advantages to those now existing, they have proved themselves men of liberal and cultivated minds; and it is not to be doubted, if the present standard of acquirement with which Officers enter the service be maintained, and with the facilities now offered by the Institution, that there will never be wanting able and educated Artillery Officers for every possible position which they may be called upon to fill.

I have, &c.

A. H. Clough, Esq.

(Signed) H. D. Ross,
Adjutant-General, Royal Artillery.

List of Officers of the Royal Artillery holding Civil and other Appointments which remove them from their Regimental Duties.

Major-General Maclachlan	Inspector of Revenue Police, Ireland.
Major-General Williams	Military Commissary, Head-quarters, Turkish Army.
Lieutenant C. C. Teesdale (Brevet Lieut.-Colonel.)	Aide-de-camp to do.
Colonel Pickering	Secretary to the Select Committee.
Captain F. A. Campbell	Assistant do. do.
Colonel Tulloh	Superintendent Royal Carriage Department.
Captain H. Clerk	Captain Instructor do.
Lieut.-Colonel Askwith	Superintendent Powder Factories.
Major J. F. D. Baddeley	Captain Instructor do.
Lieut.-Colonel E. Wilmot	Superintendent Royal Gun Factories.
Captain Vandeleur	Captain Instructor do.
Lieut.-Colonel W. H. M. Dixon	Superintendent Royal Small Arm Factories.
Captain J. P. Warlow	Captain Instructor do. do.
Captain E. M. Boxer	Superintendent Royal Laboratories.
Captain G. H. I. A. Fraser	Captain Inspector do.
Captain A. S. Orr	Captain Instructor do.
Captain R. C. Romer	Assistant Firemaster, Portsmouth.
Colonel Wilford	Director of Artillery Studies.
Captain W. H. R. Simpson Lieutenant G. K. Taylor	Under the Director of Artillery Studies.
Lieut.-Colonel Maberly	Purchase of horses and mules in Spain, for the Crimea.
Captain A. Earle	Employed under Lieut.-Colonel Maberly.
Lieut.-Colonel Elwyn	Assistant-Inspector, Royal Military Academy.

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Lieut.-Colonel P. Maclean	Superintendent Carshalton School.
Captain E. Palmer	Assistant Instructor Surveying, at Royal Military Academy.
Captain C. F. Young	Instructor Practical Artillery at Royal Military Academy.
Major C. H. Owen	Assistant do. do.
Lieut.-Colonel Smythe	Employed on special service connected with purchase of arms, powder, &c.
Lieut.-Colonel Rowan	
Lieut.-Colonel Wodehouse	
Lieut.-Colonel Lefroy	Employed in War Department.
Captain C. W. Younghusband	Secretary to the Royal Artillery Institution.
Captain A. C. Gleig	Superintendent of Military Schools.
Colonel C. Dickson, C.B.	Commanding Artillery of the Turkish Contingent.
Lieutenant Lyons	Aide-de-camp to do.
Lieut.-Colonel Crofton	Commanding Osmanli Horse Artillery
Captain Colclough	Employed with do.
Captain Bent	
Captain Breden	
Captain A. H. Murray	
Captain G. M. Pasley	Aide-de-camp to General Michel, Turkish Contingent.
Major Biddulph	In charge of Electric Telegraph, Crimea.
Major Oldershaw	Employed with Electric Telegraph.
Captain Spurway	
Lieutenant J. K. Holdsworth	
Lieutenant A. K. Rideout	

(Signed) HEW D. ROSS, Royal Artillery.

From MAJOR-GENERAL CHESNEY, R.A.

MAJOR-GENERAL CHESNEY, R.A.

GENTLEMEN, Ballyardle, by Newry, April 24, 1856.

IN reply to the queries which you have been so kind as to send me, I beg leave to forward the accompanying observations, restricting them, as you appear to have intended, almost entirely to the best mode of re-organizing the system of training officers for the Scientific Corps.

I feel, and indeed do take, no common interest in your proceedings, which are, I trust the harbingers of better times for the once so called Ordnance Corps; and I shall rejoice to find that your attention is about to be given to the larger question of giving well-instructed Officers to the army at large, instead of being confined, as at present, to two sections of this important whole.

The view long taken by me of the lamentable deficiency of military education has caused me to write under serious disadvantages, such, in fact, as could not have been felt if the objects of inquiry had been less restricted than they are.

Does not the Nation require an establishment somewhat similar to Addiscombe, in which instruction up to a certain point might be given to the future Officers of Her Majesty's army, whether destined for the Cavalry, the Artillery, the Engineers, or the Infantry?

Competitive examinations might take place at a suitable age,* from a very enlarged list, say ten times the number of Cadetships. Those so admitted would have their future arm decided after a certain time by means of another Competitive Examination, when those who are to belong to the Artillery and Engineers would be removed to another establishment for the practical and special study of the Scientific Corps.

Lastly, a selection by another Examination, not only from the two Scientific Corps, but also from Officers of the Line who are qualified, might be placed in another establishment, in order to be prepared for the Staff, as well as general commands in the army.

Many advantages would be the result of some general system of education,

* In a paper sent by me, on the 13th October 1855, to Colonel Portlock, R.E., on the subject of a more general system of Military education, a late age was proposed, in order that the education of the candidates might be sufficiently advanced.—F.R.C.

Major-General Chesney, R.A.

nor would these be lessened by including the East India Cadets, if space and other circumstances permitted this to be done.

It is high time that by these, or some other means, an education should be made imperative in the case of receiving Commissions, and that a taste for improvement should be fostered by causing an Examination to precede each step of promotion up to the grade of Lieutenant-Colonel.

I have, &c.

(Signed) F. R. Chesney, Major-General.

Lieut. Colonel Yolland, R.E., Lieut.-Colonel Smythe, R.A.,
and the Rev. W. C. Lake, Examiner for Appointments, &c.,
Commissioners appointed by the Secretary for War, &c.

The Commissioners appointed by the Secretary of State for War have propounded certain questions with respect to the important subject of "the best mode of re-organising the system of training Officers for the Scientific Corps."

Question 9. Do you think it would be more advantageous to the Public Service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive Examination,) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the Scientific Studies, as well as in the Modern Languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

Systematic Education compared with other Kinds of Instruction.

Of the six points which have thus been brought forward for consideration, as applying to Artillery and Engineer Officers, merely as such, the last may with propriety first claim attention, since it raises the serious question of the comparative advantages of a Military Establishment for training and educating Officers, and the alternative of direct appointments at a later age, for those who may have been qualified by pursuing their studies elsewhere.

The pressure which has caused the Government to resort to direct Appointments may probably be considered as merely temporary, and it thus becomes a question of choice, in time of peace, whether a youth should pass through the Royal Military Academy, or should come forward at once as a Candidate for a Commission. It appears to me that the superiority is almost unquestionably on the side of the Academy, on account of the lasting advantages which must be the result of an uniform system of education. The success of the Military Colleges and other Establishments in France, and elsewhere on the Continent, and in America, for the instruction of Officers, goes far to decide this question; and as regards Officers of the Line, we have examples at home.

Sandhurst Cadets and other Officers of the Line.

Take, for instance, an Officer who has gone through Sandhurst with ordinary success, and another who has received his Commission after a satisfactory Examination; supposing their general knowledge and acquirements to be equal, would not the Cadet be unquestionably much better prepared for the special duties of an Officer? Nor is this all, for harmony and a mutual good understanding for life, seldom fail to result between Officers, from early association in their studies and occupations for two or three years; and the seeds thus sown frequently last for life.

In the absence of a centralized System, including the Line, an Establishment for the Artillery and Engineers should be organized.

If, then, it should not be considered advisable to adopt some kind of centralized system of military education, which might include the Cavalry and Infantry up to the proper time for separating the different arms; and if we confine our attention to the scientific branches alone, there does not appear to be anything to prevent the establishment of a military seminary on such a scale as would secure to the students all the advantages of this enlightened age. Such an establishment should give the spur of competitive examinations during the progress of the student, and also that system of discipline and subordination which cannot be acquired by those who study in different establishments in various parts of the country. Hitherto the Artillery and Engineers have been exclusive, and, may it not be added, *excluded* services also. Should this continue, let us hope that the advantages of a joint and judicious system of education will be secured to the Scientific Corps in the way now about to be mentioned, or something similar. The age of admission might be eighteen, or between seventeen and nineteen, so as to permit a general education to be obtained previously to becoming a candidate for one of the Scientific Corps.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the Public Service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

MAJOR-GENERAL CHESNEY, R.A.

The eighth question opens a wide field, especially that of "the union of the two Corps of the Artillery and Engineers," and "whether it can be entertained as a question of education."

The Artillery and Engineering branches offer a wide field for Study.

Each of these branches of our army offers a wide field for the exercise of general scientific attainments. The successful improvements made of late years in Great Britain in arts and sciences have not been shared by our Officers of Artillery, who have experienced the mortification of receiving lessons from civilians, even in the powers and capabilities of their own arm. We may, perhaps, find an explanation in the fact, that studies, whether theoretical or practical, have not been so attended to, as to give an opportunity for the development of genius and talent.

Their Duties in the Field are closely linked, and depend upon one another.

It is scarcely necessary to observe, that the Artillery and the Engineer Services are so closely linked, and so inseparably dependent upon one another that in order to be really effective in the most telling operations of war, such as the attack and defence of military positions, they cannot be separated for an instant, without the greatest possible disadvantage.

Enlargement of the Studies desirable.

We are all aware that the most perfectly executed work, whether permanent or merely a temporary defence in the field, would be almost useless without well-served artillery, and we also know that the power of artillery would be equally lost were the batteries so placed that the guns could not be brought to bear upon the enemy at the proper moment. It follows, therefore, that although, apart from warlike operations, and especially during peace, there may be objects which require specific and separate attention from the Engineer as well as the Artillery Officer, the duties of both during a campaign require the same kind of education. It is therefore not only desirable to carry their joint instruction a good deal farther than is at present done, but also to follow this up by a more enlarged practical course. This might, with infinite advantage, include the determination of astronomical points, the construction of permanent and field works, as well as mining operations, the erection and armament of batteries, the study and application of chemistry, the use of the steam-engine and telegraphic communications of various kinds, and all that relates to artillery and military engineering.

Mining and other things to be taught.

Artillery and Engineer Officers to perform separate Duties ultimately.

A similar education, in every respect, being imparted to the Artillery and Engineer Officers, the doubt may be expressed, though not without some hesitation on my part, bearing in mind how closely, and as regards success, inseparably, the two services are linked together, whether anything would be gained by considering the same Officer equally fit for each kind of duty. It is probable that, as is the case in the ordinary avocations of life, more would be gained by eventually giving the undivided and concentrated energies of an Officer, whose education has been completed, to his own especial branch, whether that of the Artillery or Engineers. I should therefore strongly advocate their being considered as separate Corps, from the time that the Officers receive their permanent Commissions.

Partial readjustment of some Branches.

A re-adjustment might, however, be advisable with respect to two branches, which with every advantage, may be transferred to the Artillery, viz. the construction of batteries, and the management of pontoon trains. These branches belong to the Artillery in the French as well as in some other services, and for apparently valid reasons.

Construction of Batteries.

In the instance of batteries, time would be gained by allowing the Artillery to construct their own, which work could be proceeding whilst the Engineer Officers are attending to other portions of the attack, and it would, besides, appear desirable that those who fight the guns should arrange the means of covering them, and laying the platforms, which are so essential to their efficiency.

The Pontoon Train to be attached to the Artillery Service.

With regard to pontooning, and more especially the main operation of transporting heavy and light Artillery across rivers, it seems to follow, as a matter almost of necessity, that the means of accomplishing this serious task should be an integral part of the Artillery material, from which, in fact, as an operation, it ought not to be separated.

MAJOR-GENERAL CHESNEY, R.A.

Studies of the young Officers.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Artillery, after joining their respective Corps?

In reply to this question it may be stated, that young Officers, on joining the Corps, as well as those who receive direct appointments, have access to the Artillery institution, and enjoy the very great advantages of a laboratory, a lecture room, a library of reference, and a museum.

They are placed under the charge of a Lieutenant-Colonel of Artillery, and study daily, but for much too short a period of time, higher mathematics, theoretical fortification, military science, and practical artillery; in addition to which, and the study of modern languages, they receive instruction in horsemanship, and go through a course of drill.

Continuation of Study during the temporary Commission of Officers.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

An extension of the time employed under the Superintendent of Studies, is not only desirable, but absolutely necessary. If, without appearing to go too far, we may consider the instruction already received in the Royal Military Academy to be the foundation of a good education rather than education itself, it follows that the previous course of study should not only be followed up, but should be a good deal enlarged during the probationary appointments; while at the same time, due attention should be paid to the important objects of drill and practical acquirements at large.

It seems all but impossible that any Officer, however great his talents and acquirements may be, could fulfil the task with which Lieutenant-Colonel Wilford is intrusted. Indeed, it is clear that assistance, and this to a very considerable extent, is indispensably necessary for the instruction of young Officers, if it be intended to qualify them, both theoretically and practically, to do honour to their profession. It is evident that to arrive at the effective use of the various missiles, as well as of the powerful engines connected with artillery, a greater amount of scientific knowledge is required than our Officers have as yet brought to bear on this branch of the art of war.

Practical Artillery,

Question 6. Does any institution for Officers of the Artillery, similar to the Senior Department at Sandhurst, appear to you to be desirable?

Practical artillery of itself opens a very wide field for study, since success in this branch would involve a knowledge of the casting, boring, and general use of metals as applied to fire-arms in general; also an intimate acquaintance with the science of fortification, the theory of projectiles, practical mechanics, and natural philosophy, particularly with that branch comprising chemistry, which, on account of the manufacture of gunpowder as well as of the various preparations of the laboratory, is of the greatest importance.

and other Studies.

In addition to these, other subjects also claim the attention of the students during the period of their probationary commissions, such as modern languages; ancient, modern, and military history; statistics; military administration and legislation; geography; topography; plan drawing: reconnoitering: castrametation; pontooning; and tactics in general.

Proposed Assistance to the Superintendent of Studies.

By giving professional and other assistance to a moderate extent, the Superintendent of Studies would, I doubt not, be enabled to secure a superior class of Officers without going quite to the extent of forming an establishment similar to the senior department at Sandhurst. The fact that the progress made during the time of probation is to determine the succession to permanent commissions, must of itself be a salutary incitement, and if it should be decided that an examination is to precede the Officer's advancement to a Company, and and again to a Lieutenant-Colonelcy, there is little doubt that Officers would in after life devote a great part of their time to the improvement of the mind.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Artillery in time of peace, of a nature to continue and extend the scientific studies requisite for the

The preceding observations have reference to that state of things, which, up to the memorable siege of Kars, has almost entirely excluded Artillery and Engineer Officers from general employment. Were this discouraging state of things to be re-

efficient performance of their duties in time of war?

MAJOR-GENERAL CHESNEY, R.A.

moved, by considering staff situations and commands open to them in future, we might safely reply to No. 7 by saying that an addition could "be advantageously made to the duties at present assigned to Officers of the Artillery or Engineers in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war."

Proposed Establishment for the Instruction of Staff Officers.

For this purpose, a regular establishment might, with great propriety, be substituted for that described in answer to No. 6, which instead of being confined to Artillery and Engineers, should carry out their instruction in connection also with that of Officers of the Line to such an extent as to be a preparation for the general staff of the army. In fact, it should embrace the very extensive field of the art of war in its largest sense; and the instruction of those who in the beginning of their career are to assist the Generals, and at a later period may conduct armies themselves.

Objects to be attained.

We have for this purpose the senior department at Sandhurst, as an example at home, and L'Ecole d'Etat-Major in France. This is only open to those Officers who, in addition to the education received elsewhere, have had the advantage of having served, for a certain time, in the Infantry, the Cavalry, and Artillery. Doubtless the Commander of an army, as well as the Generals of Divisions and Brigades, should be prepared by their previous knowledge to use either of the three arms with the most telling effect; and the knowledge of the Artillery and Engineer Officer must also be largely exercised, particularly when sieges or defensive positions are in question.

It is therefore clear that an officer's instruction should not only embrace those objects theoretically, but practically also, if by any means circumstances permit of his doing so. In addition to the branches of study already enumerated in connexion with No. 6, the preparation for the superior ranks of the army should include the geology of several countries, with a knowledge of some of the principal languages of the Continent.

Branches of Study.

Practical astronomy, including the determination of latitudes and longitudes; sapping and mining; a complete knowledge of fire-arms, ancient and modern; military architecture; the application of steam-engines, and the use of diving-bells, telegraphs, and electric wires for warlike purposes; and, in connexion with offensive and defensive positions, the study of European countries, their means of defence, and their resources of all kinds. The latter objects, however, are only mentioned as a small part of the considerations involved in the vast question of warlike operations—a question which embraces too large a field to be more than indicated in these brief replies.

(Signed) F. R. CHESNEY, Major-General.

Packolet, County Down, April 24, 1856.

From MAJOR-GENERAL SIR R. J. DACRES, K.C.B., from R.A.

MAJOR-GENERAL SIR R. J. DACRES, K.C.B., from R.A.

GENTLEMEN, Camp before Sebastopol, April 16, 1856.

I AM unacquainted with the present mode of education at the Academy at Woolwich; and the only suggestion I can make from my experience in the Crimea is, that the knowledge of languages has not sufficient credit given to it at the examinations, and I feel confident that if more encouragement was given to this important branch of study, English Officers would be better linguists, and the service be very materially benefited.

I have, &c.

(Signed) R. J. DACRES, Lieutenant-General.

From COLONEL ST. GEORGE, C.B., R.A.

COLONEL ST. GEORGE, C.B., R.A.

Question 10. As the result of your observations in the Crimea, would you say that in any points of practical or scientific knowledge, the education of the Officers of the Artillery or Engineers,* as at pre-

The professional education at the Academy not susceptible of improvement.

As the result of my observations in the Crimea, I would not say that in any points of practical or scientific knowledge the education of the Officers of the Royal Artillery, as conducted when at the Academy, is susceptible of improve-

* The answer to be given in reference to the Corps to which you belong.

Colonel St. George, C.B., R.A.

sent conducted, is susceptible of improvement?

ment. I think, however, that such professional knowledge has seldom been called upon in times of peace, and has sometimes become a little rusty.

Question 11. Can you make any suggestions with the view for the improvement of the teaching now given at the Academy at Woolwich?

I can make no suggestions with the view of the improvement of the teaching now given at the Academy at Woolwich. The boy learns enough; all that is necessary is to prevent the man forgetting it.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Artillery, or in the Engineers, after joining their respective corps?

There is no instruction or assistance in their professional studies supplied to Officers in the Artillery after joining the Corps, except at the Head-quarter Station, where an Officer is employed in superintending the professional studies of those who have just left the Academy, and may be quartered at Woolwich.

Officers require a motive for exertion rather than further theoretical instruction.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

With the amount of information an Officer must possess on joining the regiment, together with the facilities that exist of increasing it unaided, farther assistance in the prosecution of theoretical study is not, I think, desirable. What is desirable is a motive to stimulate him to exertion.

The constitution of the regiment should involve an organized system of instruction.

The whole time of an Artillery Officer in peace should be spent in gaining and imparting professional information. An organized system of instruction should be inherent in the constitution of the regiment—not in name, but in fact. Commanding Officers, at all stations, should call daily upon those below them for reports, surveys, sketches, plans, reconnaissances, and all the varied duties of their profession; and all appointments, advantages, and rewards should be given alone to such as perform these duties best.

Senior Department for Artillery desirable.

Question 6. Does any institution for Officers in the Artillery, or in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

An institution, similar to the Senior Department at Sandhurst, appears desirable; but as study must be looked on as a means, and not an end, such institution would be useless in the Artillery, unless it were known to lead the student to some definite and tangible advantage hereafter.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Artillery, or in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

No especial employment of Artillery Officers, in addition to their present duties, occurs to me; although I feel sure that the more Officers are called upon to do, the better it will be for the service and themselves.

Officers withdrawn for civil employments to be made supernumary.

I should suggest that encouragement should be given for the employment of Officers of the Royal Artillery in the public service, in any capacity for which their talents or acquirements fitted them; by making, in all cases, such Officers, if withdrawn from their military duties, supernumerary of their rank.

An amalgamation of the two corps would be beneficial.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

I confess I do not understand this paragraph. If it is meant to ask whether an absolute amalgamation of the Ordnance Corps is considered desirable, I am of opinion that it would benefit the service and the individuals. My own experience convinces me that the selection made when we are boys, for the two distinct corps (and which has hitherto been irrevocable), has no reference whatever to the adaptation of the individuals to the especial duties of either. Those Cadets

who were highest on the list, if they had behaved well, have generally been allowed to choose their corps. If the two could be merged in one, all Officers could hereafter be employed in the duties they could best perform.

COLONEL ST. GEORGE, C.B., R.A.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination,) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

I am of opinion that instruction in scientific studies, languages, &c. should be obtained elsewhere, and that passed candidates should proceed at once to what is now called the Practical Class. I would extend considerably the duration of the candidates at this establishment; and I would add to the subjects taught at present, permanent fortification, and afford opportunities for improvement in modern languages.

Instruction should commence with the Practical Class, science, languages, &c., having been taught elsewhere.

(Signed) J. ST. GEORGE,
Lieut.-Colonel Royal Artillery, and Colonel.

Sebastopol, April 12, 1856.

From COLONEL WILFORD, R.A., Director of Artillery Studies at Woolwich.*

COLONEL WILFORD, R.A.

Department of Artillery Studies,
Woolwich, April 15, 1856.

SIR,

I HAVE the honour herewith to transmit my answers to the printed questions you enclosed to me with your letter of March 11, 1856.

Some of these questions refer to the constitution of the Royal Military Academy, and I would, as a member of the Academy Committee, desire to reserve my opinion upon such points until I shall be in possession of the information which the Commission will have obtained in foreign countries.

I have replied to some questions, copies of which I obtained from Lieut.-Colonel Wilmot, since they appear to me to refer to my particular duties as Director of Artillery Studies.

Question 18. Will you have the goodness to inform the Commission of the nature of the instruction that has been afforded to young Officers of the Artillery immediately on joining their regiment at Woolwich, and of the causes and circumstances which led to its being given?

I am not aware of all that may have been done in this direction, and shall simply state what occurs to my recollection.

Instruction afforded to Officers on joining.

For some years after I joined the Corps of Artillery, in 1817, all Officers on first joining were put through courses of instruction in the Royal Laboratory and Royal Military Repository.

They also attended what would now be termed Field Battery Drill, and Mortar and Howitzer Practice.

After the establishment of the Practical Class at the Royal Military Academy, I believe the necessity was not felt to exist of putting Officers, on first joining, through regular courses of instruction in the Royal Laboratory and Royal Military Repository, but young Officers were ordered to visit the various departments in the Royal Arsenal, the Repository, and to render weekly reports to their Commanding Officers, showing how they had employed their spare time, and what professional studies they had pursued.

I have understood that this system was not found to work well, and finally a Director of Artillery Studies was appointed to superintend the professional studies of the Officers on their first joining; but I am not aware of the precise course the Officers who held this appointment followed. I know, generally, that much useful information was conveyed to the young Officers on the subjects of the Art of War, Military Sketching, and Military Law.

Director of Artillery studies;

Question 19. Will you state whether it is still given, and if not, under

At present, no young Officers, except those provisionally commissioned with

who has ceased to superintend any but those provisionally commissioned.

* Now Governor of the Royal Military Academy.

Colonel Wilford, R.A.

what circumstances it has ceased to be so?

temporary rank, are placed under the orders of the Director of Artillery Studies for instruction. I apprehend, but am not accurately informed on the point, that the practice was discontinued owing to the extraordinary demand for Officers during the war now terminated.

Question 20. What was the usual amount of mathematical knowledge possessed by Officers on joining this course, during your connexion with it?

I have never had charge of the instruction of young Officers joining from the Royal Military Academy.

Question 21. What in your opinion is the proper amount of mathematical knowledge which should be possessed by a young Officer on joining the regiment?

A sound knowledge of the course of mathematics as laid down in the printed regulations of the Royal Military Academy. With this knowledge, if in his possession, he ought to be able to pursue such mathematical investigations as he may require to make in the exercise of his profession.

Question 22. Without reference to what may be the present state of teaching, what do you consider the education, both scientific and practical, which would most completely qualify an Officer of Artillery for the discharge of his various duties?

A sound knowledge of the following:—

1. Pure and Mixed Mathematics, including Natural Philosophy, Theory of Gunnery, &c.
2. Practical Mechanics.
3. Chemistry.
4. Metallurgy.
5. Fortification, Field and Permanent, including the Attack and Defence of Fortresses, Posts, &c.
6. Topographical Drawing.
7. Surveying, Military Sketching, and Reconnoitering.
8. Geometrical Drawing, as applied to the drawing of guns, carriages, and machines.
9. The Construction of the various materiel of the Artillery.
10. General principles of the Art of War.
11. Good command of the English Language.
12. Accounts and Book-keeping—every Captain Royal Artillery being his own Paymaster.
13. The French Language, so as to write and speak it.
14. The Principles of Military Law.
15. Infantry, Artillery, and part of Cavalry Drill.
16. Good Equitation, and the care and management of Horses.
17. Throwing up and constructing Batteries and Field Works,
18. Military Bridges.

Question 30. Referring to the list of Officers, Professors, and Masters attached to the Academy, will you state whether you consider that there is or is not an insufficient amount of instruction afforded at the Academy? And will you particularize any branches of study which in your opinion should be added to or taken from the existing course?

Presuming that, as a member of the Academy Committee, I shall be called upon at a future period to state my views as to the future constitution and arrangements of the Institution, I will not now offer a premature opinion.

Question 31. Is there, in your opinion, any deficiency in the staff of Professors and Masters at the Academy?

Understanding clearly that Lord Panmure has decided that the Academy shall become a School of Application of Science to Artillery and Engineering, that the candidates shall be admitted according to the degree of qualification they exhibit at an open competitive examination, and that these candidates shall be of the comparatively advanced age of between seventeen and twenty years, I should prefer to reserve my opinion as to the course of study, number of Professors and Masters, until I shall, through the labours of the Commission, become better acquainted with the systems of military education pursued in foreign countries.

(Signed) E. N. Wilford, Colonel Royal Artillery.

Second Series of Questions.

These questions were not sent to me; I obtained a copy of them from Lieut.-Colonel Wilmot, R.A. As some of them have especial reference to my particular duties as Director of Artillery Studies, I have thought myself justified in replying to them, it resting with the Commissioners to advert or not to my answers as they may see fit.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Artillery, or in the Engineers, after joining their respective Corps?

Courses at the Royal Artillery Institution.

Gratuitous instruction in Military Sketching and Surveying, in the French and in the German languages, is supplied in connexion with the Royal Artillery Institution to all Officers desiring to pursue a voluntary course of study in those branches.

Question 5. Would it be possible, and if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

The interruptions of military duty make it difficult to enforce any regular and compulsory courses of study upon young Officers after their first joining to do duty at Woolwich.

Nevertheless, by acting in concert with the Major-General the Commandant, who is also the Commanding Officer of the Royal Artillery, much that is useful might be accomplished.

Studies which might be made compulsory.

Young Officers might, under the superintendence of the Director of Artillery Studies, be required to pursue the study and practice of Military Sketching and Reconnoitering, to take up the study of the French or German languages; they might receive instruction in Military Law, Military Finance, Military History, and the Art of War.

It is believed, that if brought officially into connexion with the Director of Artillery Studies, he might in some sort direct and guide the choice of books and professional reading of the young Officers, direct their attention to proper objects in the manufacturing departments of the Royal Arsenal, and, might in many instances exercise a beneficial influence on their minds.

It must, however, be observed that these objects must be effected in subordination to the calls of Military duty, which, under any regulation that could be devised, would more or less interrupt regular application.

Question 6. Does any institution for Officers of Artillery or Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

Advantages of Senior Department.

Witnessing, as I do, the daily difficulty Officers encounter in their attempts to pursue voluntary courses of study at the Royal Artillery Institution, I am of opinion that it would be a great benefit to the Corps of Artillery if a limited class of Officers were withdrawn from all military duty for a fixed period, say twelve or eighteen months, with a view to their pursuing a regular course of study under competent instructors at the Royal Artillery Institution.

Qualifications for admission to it.

No Officer being eligible to enter the class who had not done three or four years' military duty, or who could not pass a satisfactory examination, showing that he possessed good talents, and had retained the theoretical acquirements he had attained at the Royal Military Academy.

The course to be partly special, that is, having an exclusive bearing on the science of Artillery; and partly general, that is to say, qualifying the Officer for general or staff duties.

Without entering further into details, it may be remarked that such a plan would afford the Corps of Artillery a proportion of Officers of developed talents and *known* scientific attainments who would be available for any duties that might be required, and who might be expected to contribute to the improvement of Artillery science.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Artillery in time of peace, of a nature to continue and extend the

Artillery Officers to be attached in time of peace,

Artillery being eminently a progressive art and science, experiments and supposed improvements are constantly being made in the Continent of Europe and in North America.

Colonel Wilford, R.A.

scientific studies requisite for the efficient performance of their duties in time of war?

It is conceived that an intelligent Officer of Artillery should be attached to all our foreign embassies of any importance, with orders to report upon all Artillery matters of interest of which he could gain a knowledge.

1. To our foreign legations,

2. To Infantry, Cavalry, and the Engineer Establishment at Chatham,

3. To the General Staff,

4. To be employed on scientific missions.

Officers of Artillery might with much advantage be attached for short periods to Corps of Infantry or Cavalry, and to the establishment of the Royal Engineers at Chatham. A certain number of Artillery Officers should be employed on the General Staff of the army, and in scientific missions; for instance, such as to report on the iron mines and iron manufactures of Sweden.

Although not a question of education, it is assumed that a sufficient Peace Establishment of Artillery Officers will be maintained to admit of such employments and such missions.

Unless a considerable establishment of Artillery Officers be kept up in peace it becomes impossible to supply the demand on the breaking out of a war, since, so to speak, Artillery Officers cannot be improvised.

Duties of the Artillery.

Question 8. Do you consider that any re-adjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

While I am of opinion that the British Artillery should perform all the duties assigned to the Artilleries of France, Spain, and the German Powers, I do not see how such points can be treated as questions of education.

School of Application—theoretical instruction to continue throughout the course.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination,) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

So far as I understand it has been already decided by Lord Panmure, that the Royal Military Academy shall be a School of Application.

As a member of the Academy Committee, I feel precluded from any premature detail of my views as to the course of study and training to be pursued at that institution. I will only observe, that I would abolish the term *Practical* Class, and blend together theoretical and practical instruction to the last day of residence.

I have, &c.

(Signed) E. N. Wilford, Colonel Royal Artillery,
Director of Artillery Studies.

A. H. Clough, Esq.,
Secretary to the Commission for Reporting on the
Education of the Scientific Corps.

Lieut.-Colonel Wilmot, R.A.

From Lieut.-Colonel Eardley Wilmot, R.A., Superintendent of Royal Gun Factories, and formerly Second Captain Commanding Cadet Company, to the Secretary.

Sir, Woolwich, June 10, 1856.

Having understood that some surprise has been expressed at my not having sent any reply to a series of questions forwarded to me, proposed by the Sub-Committee, relative to the question of education in Continental States, I beg to explain, that my not having done so does not arise from any want of interest in these important questions. Having been for several years connected with the Royal Military Academy at Woolwich, and having for many years previously had these matters in view as regards the Army generally, it cannot be supposed that my interest has abated when it would appear that the time for

the extensive circulation of opinions upon them has arrived; but it appeared to me that the Sub-Committee had been absolutely *selected* by the original Committee; and having distinctly understood that the report of the former would come under the consideration of the latter, I did not wish to bind myself to any expression of opinion until I had ascertained if any of the information to be obtained by the Sub-Committee was likely to alter or modify the opinion which I had formed after many years' consideration, opinions which I am happy to see in part taken up by other persons in the House of Commons.

It is not likely that I should have agreed to select an Officer to represent the Artillery Service on any other supposition. A Sub-Committee containing at least one member then for the first time entering on the question of Military Education, and at that time ignorant of the wants of the Army in this respect, could have no other meaning, in my mind, than what was, I believe, the original intention,—*a Sub-Committee to collect information* on these points, on which many members of the Committee had no information.

Whether or not the original intention of this Sub-Committee has been altered, I have no means of ascertaining; but I can hardly imagine that such has been the case, or that it is likely that on so important a question the original Committee will be altogether set aside, unless it is proposed to form a new Committee to go into the whole question.

These are the considerations which have prevented my sending any reply.

I beg that this letter may be added to the documents of the Sub-Committee.

I have, &c.

(Signed) F. Eardley Wilmot, Lieut.-Col., R.A.,
Superintendent of the Royal Gun Factories.

The Secretary of the Sub-Committee,
&c. &c. &c.

Reply from the Secretary to Lieut.-Colonel Eardley Wilmot, R.A.

Sir, War Department, June 13, 1856.

I have the honour to acknowledge your letter of the 10th instant, which I submitted to the Commission at their meeting yesterday.

I am directed to request your attention to the terms of the first paragraph of the letter (which has, it is presumed, already been forwarded to you, but a copy of which is enclosed), dated Metz, 11th March 1856.

I am to add that, should you be disposed, after considering that paragraph, to furnish any evidence to the Commission, the Commission will have much pleasure in receiving it.

I have, &c.

Lieut.-Colonel Eardley Wilmot, R.A. (Signed) A. H. Clough.

From Lieut.-Colonel Eardley Wilmot to the Secretary.

Sir, Woolwich, June 16, 1856.

I beg to acknowledge your note of the 13th instant and the enclosure. By this I find that I have erroneously used the term "Sub-Committee" instead of "Commission," an error for which I am glad to have now an opportunity of apologizing. As the Commission is "to consider the *best* mode of re-organizing the system of training Officers for the Scientific Corps," and not, as I imagined, to consider the *several* modes, I am the more strongly impressed than ever with the necessity of withholding any opinion which has an official character until some future occasion, particularly as it says "of," and not "for," in the last paragraph.

I have, &c.

(Signed) F. Eardley Wilmot, Lieut.-Colonel, R.A..
Superintendent Royal Gun Factories.

The Secretary to the Commission for Reporting on the
Education of the Scientific Corps.

Colonel Barker, C.B., R.A.

From Colonel G. R. Barker, C.B., R.A.

Sir, Woolwich, April 18, 1856.

With reference to the questions sent me from the Commissioners appointed to report upon the education of the Scientific Corps, it appears that during the two or three years immediately preceding the breaking out of the war, Officers, upon first joining the Royal Artillery, were obliged to go through a certain course of study, both practical and theoretical, under an Officer appointed for the purpose; but the requirements of the service upon the commencement of hostilities prevented the continuance of this custom, and it has not since been resumed. There is no doubt that much benefit was derived from it, but I think still greater results would have been obtained had the Officers, after leaving the Academy, performed their regular duty with the regiment for at least one year before commencing this course of study, to which they would then, after such relaxation, have devoted themselves with more earnestness.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Artillery or in the Engineers after joining their respective corps?

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

Question 6. Does any institution for Officers in the Artillery or in the Engineers similar to the Senior Department at Sandhurst, appear to you to be desirable?

A year's regimental duty previous to the course of study after joining would have been attended with advantage.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Artillery or in the Engineers in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

The education of the two corps should be entirely separate.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination,) proceed at once into what is termed a Practical Class, or be sent for one or two years to a military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

In answer to the questions generally, I would suggest the following plan for the education of the Officers of the Royal Artillery, and it appears to me extremely probable that separating the two corps (Artillery and Engineers) entirely, in point of education, would be beneficial to the service. The candidates, from the age of sixteen to eighteen, being nominated as at present for the Royal Military Academy, to undergo a public examination with a view to ascertaining that they have received a good general education, modern languages and mathematics being considered essential, the best of course to be selected. They should then be sent to a military college for about two years, for the purpose of continuing their scientific studies, and the study of the modern languages, as well as for instruction in the more practical part of their duties, which should combine the course now in use at Chatham for young officers, as well as that for the Practical Class at Woolwich. They should then, after passing an examination, obtain commissions, join the regiment, and do duty with their companies in whatever part of the world they may be stationed, for one, two, or three years, as may be considered desirable at the time, according to the exigencies of the service, and the distance of the station from England. They should then return to Woolwich, and go through another course of study, as was the custom before the commencement of the recent war; and having completed this course of study, they should, after again passing an examination, rejoin the regiment for general duty. But, in order to assist Officers afterwards in acquiring or keeping up information, I would recommend an institution somewhat similar to the Senior Department at Sandhurst, the instruction afforded being of course of a much higher order, and

Senior Department recommended.

should include chemistry and mineralogy, at least as far as they may be applicable to the manufacture of guns and gunpowder. I cannot help thinking the system of opening the public examination for admission to the regiment to all classes without distinction, extremely objectionable, and I have therefore recommended that all candidates for commissions in the Royal Artillery should be nominated as at present for the Royal Military Academy, by the Secretary of State for War or by the Commander-in-Chief.

COLONEL BARKER, C.B., R.A.

Admission by examination without a previous nomination extremely objectionable.

It would tend materially to the advantage of the service, if, in the field, many of the duties at present performed by the Engineers were allotted to the Artillery, such as the construction of batteries and entrenchments, both in defensive positions and in the attack of fortified places; the Artillery Officer is the only person properly capable of estimating the effect of his own fire upon the enemy, or that of the enemy upon his own works and batteries. To him, therefore, should be delegated the selection of the positions of the batteries, and their construction (as he has to fight them), as well as the nature of the armament; and, in order to enable him to perform these duties satisfactorily, he should go through the same practical course as the Engineers on first joining at Chatham, and the gunners should be instructed in the same manner as the Sappers.

The nature and extent of the duties which an Artillery Officer is liable to be called upon to perform are so important and various, that there is scarcely any science a knowledge of which may not, at some time or other, be not only useful but necessary to him; and to assist him in acquiring such information, an institution similar to the Senior Department at Sandhurst, the formation of which I have recommended, would be most useful to him.

I have, &c.

(Signed) GEO. R. BARKER,
Lieut.-Colonel, R.A., and Colonel.

A. H. Clough, Esq.

From LIEUT.-COLONEL GARDNER, R.A.

LIEUT.-COLONEL GARDNER, R.A.

These answers relate to the Artillery.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Artillery after joining their respective corps?

The assistance in professional studies, under the superintendence of the Inspector of Studies, is at present very limited, but the course is in a transition state, and it would appear unnecessary to comment upon it.

Further instruction should be afforded to Artillery Officers after joining.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it.

The great demand for Officers having ceased, it is possible and very desirable that further instruction and assistance should be given to Officers on joining. If the young Officer has previously passed through the Academy, then nine months or a year of special instruction might suffice, during the last three months of which he should be attached to a battery.

A year or nine months' study after the Academy would be sufficient.

Should the young Officer join direct, after a public competitive examination, then a longer time under special instruction will be necessary.

The general nature of his studies is indicated in the following answer:—

Question 6. Does any institution for Officers in the Artillery, similar to the Senior Department at Sandhurst, appear to you to be desirable?

Such an institution is not only desirable, but absolutely necessary, if the efficiency of the Artillery Service is aimed at.

Senior Department not only desirable but necessary.

The institution should teach, first, to Officers of some standing, the manufacturing duties of Artillery, whether for the departments at home, or for the smaller but not less important establishment, "the parks" for repairs of material in siege trains, and also in garrisons. The want of these establishments for repairs constitutes one great defect of the Artillery service. Second, the special duties of Artillery as regards its application. Third, general staff duties.

First. Manufacture; Mathematics and Mechanics, with special reference to Artillery; Chemistry, Geology, Mineralogy; Geometrical Drawing; French

It should teach,
1. Manufacturing duties of Artillery.

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and German; Physical Geography; Strategy and Tactics; the Theory of Fortification and of Attack; the Steam-engine.

Practically.—Work in the departments.

The Arsenal course might require about three years.

2. Special Artillery duties.

Second. Artillery duties. (1.) In Garrison.—Mathematics limited as compared with the above; Fortification as above; Drawing; Modern Languages, colloquially and grammatically; Military Law and Military History; Physical Geography; Tactics.

(1.) In Garrison.

Practically.—Gunnery and general service of heavy guns; construction of platforms, blindages, expense magazines, &c., as laid down in the Repository Course, including cover for guns.

(2.) In the Field.

(2.) In the Field.—Mathematics limited; Fortification as above; Tactics; Modern Languages as above; Military Law and History, Surveying and Reconnoissance; Veterinary Science; Physical Geography.

Practically.—Gunnery, with field guns; drill, both special and associated; harnessing, shoeing, and all that relates to the care of horses; riding and driving; limited course in carriage department; construction and repair of harness; construction of temporary bridges and pontooning.

(3.) At a siege.

(3.) Artillery duties at a siege, a combination of the above.

3. General Staff Duties.

Third. General Staff Duties.—Mathematics, including Astronomy, Surveying and Reconnoissance; Physical Geography; Military Law and History; Geometrical and Landscape Drawing; Modern Languages as above; Fortification as above; Strategy and Tactics.

Practically.—Drill with the three arms; riding, fencing, &c.; and the duties, as far as they can be taught, of Adjutant-General, Quartermaster-General, and Military Secretary.

The subject of Tactics should be given to Sir W. Napier. He might prepare a course, or advise as to the construction of one.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Artillery in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

Many additions can be advantageously made to the duties at present assigned to Artillery Officers in peace, for the efficient performance of their duties in war. For example, at a siege, the assigning to the Artillery Officer the determination of sites for his guns, the construction of cover for those guns, and generally the formation of all that which directly concerns the service of the Artillery, and in which that arm is immediately concerned; all this might advantageously be given to the Artillery Officer. The formation of "parks" for repairs might also be given to him, the advantage of having one head being manifest.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

I do not understand the scope of this question. A readjustment of the functions assigned to the Artillery, as suggested above, must tend directly to the advantage of the public service, the great object aimed at in the training of the Officer. Readjusted functions will involve, on some points, more extended education; and thus readjusted functions, to insure efficiency and extended education, are inseparable.

Officers should proceed at once to the Practical class.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for in-

It is a question whether the united education given to

Officers after joining should proceed at once to the Practical Class, under the superintendence of the Inspector. A military college I think objectionable; in its present shape very much so, the principle upon which commissions are given operating directly to the prejudice of the Artillery. It is also a question whether the course of instruction there pursued is fitted for Officers whose after duties are

struction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

so widely dissimilar; whether the mathematical course, for example, does not contain much matter useful to an engineer; but unnecessary for the Artillery Officer, who again might be profited by having his attention more directed to gunnery as a science. It is also a question whether the fortification course is not carried to an unnecessary length for men destined to be with Artillery. I think the tendency of attaching so much weight to that course has been that many Artillery Officers have early received an erroneous impression of the relative importance of the two subjects, and have in consequence troubled themselves very little as to the forms of guns, shape of shot, construction of carriages, and generally little about Artillery matters. Is it not time to put the question seriously to ourselves, and discover, if we can, before another war breaks out, what constitutes the strength of fortification? We know, with men of war, that their power of striking at a distance is that which gives them strength.

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Artillery and Engineers has not been prejudicial to the former.

It is most respectfully submitted to the Committee that gunnery, whether as regards its application or construction, is one of the most important national questions.

Importance of the study of gunnery.

(Signed) W. B. GARDNER,
Lieut.-Colonel, Royal Artillery.

Woolwich, April 25, 1856.

From MAJOR CHARTERS, R.A., H.P.

MAJOR CHARTERS, R.A., H.P.

SIR, 3, Bedford Street, Bath, June 12, 1856.

I TRANSMIT answers to such questions in the printed list which you forwarded to me by direction of the Commissioners, as I could at all venture an opinion on.

I beg to assure the Commissioners that in consequence of my long separation from the service, it is with the greatest diffidence that I have approached the subject, and if I have hazarded opinions on several points of grave importance, I request that they may be considered more as an expression of my readiness to respond to the honour which has been done me, than as implying any hope of their utility.

I have, &c.

A. H. Clough, Esq.,
Secretary to the Commission for reporting on the Education of the Scientific Corps, London.

(Signed) SAMUEL CHARTERS,
Captain, Royal Artillery, H.P.
Brevet Major.

Question 5. Would it be possible, and if possible, desirable, to have further instruction or assistance given to Officers after joining; of what nature should it be, and what would be the best means of affording it?

When Officers have received their Commissions in the Corps of Artillery, their previous education at Woolwich Academy, and the examinations they have undergone, ought to ensure the possession of a considerable amount of theoretical and practical knowledge of their profession. The practice used to be (I allude to 1804–1828) to keep young Officers a year at Woolwich that they might learn their routine regimental duties before joining their respective Companies at home or abroad.

I believe any progressive professional knowledge, beyond the mere exigency of the service, will then depend mainly on the individual himself. The present constitution of the corps, by which promotion depends exclusively on seniority, is not adapted to rouse the energies of the Officers. Some master spirits will become conspicuous even in spite of this depressing system, but the great majority will be content with mediocrity and indifference.

Depressing influence of promotion by seniority.

When an Officer joins his Company either at out-stations in Great Britain or in the Colonies, he is in a great measure deprived of the means of improving, or even keeping up his practical knowledge, so that after a few years' absence, when he returns to Woolwich, it will require a considerable time, even with the best will, to replace himself in his proper position with respect to practice. It

MAJOR CHARTERS R.A., H.P.

certainly would be highly advantageous if some method could be devised of keeping up and extending the scientific acquirements which the Officers may possess.

Society for discussion of professional subjects.

Perhaps, it might be possible to establish a society at Woolwich for the reading and discussion of professional papers, formed on the model of the Geological Society of London. This, if strictly confined to professional subjects, would be a powerful means of stimulating the ambition and keeping alive the energies of its members. Much valuable matter would, no doubt, be elicited, and its transactions circulating amongst the Artillery Officers at home and abroad, would keep them informed of the progressive state of their profession, and also draw contributions from them.

The Academy, Garrison, and Arsenal at Woolwich sufficient for Artillery education.

Question 6. Does any institution for Officers in the Artillery or Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

I think that Woolwich Academy properly organized, Woolwich Garrison and Arsenal ought to suffice for all requirements of Artillery education.

The primary education for both services should be united.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers; for instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

I believe that the primary education for both services ought to be the same, and for the following reasons:—

1. It is necessary that the Engineer Officer should have clear ideas of the effect of heavy artillery on masonry and earthenworks, of the effect of shells on buildings constructed to resist them, and various other applications of the arm. The first principles of fortification, of plan drawing, in short, of all the branches mentioned in my answer to No. 5. are equally adapted to both services.

2. In uniting the primary education of the two services, another important point is gained; until the Cadet shall have entered on his studies and continued them for some time, it will be impossible for the instructors to form a just opinion of his talents and the direction they are likely to take—that is, whether he will be better fitted for the more active and military arm, or for the more scientific and varied functions of the Engineer.

3. In war, more especially in sieges, the two services are so dependent on each other, that the one may almost be said to be powerless without the other; hence, the necessity for that friendly, familiar, and intimate intercourse which I well remember existed, and I have no doubt does still exist, between the two corps, and this brotherly feeling, so advantageous to the public service, is in no small degree due to their being educated together at the same Academy. For these reasons, I believe that for the first two or even three years they should be educated together. After which time the Engineer Cadet may be removed to an establishment more suited to perfect his education.

Instruction given on joining at the commencement of the present century.

Question 18. Will you have the goodness to inform the Commission of the nature of the instruction that has been afforded to young Officers of the Artillery immediately on joining their regiment at Woolwich, and of the causes and circumstances which led to its being given?

This question and the one which follows it in the printed list allude to a course of instruction given to Officers on joining at Woolwich, which did not exist during my service in the corps. The only instruction then given consisted in field battery exercise, repository exercises, gun and mortar practice, and infantry evolutions in battalion once a week; but these were gone through with a spiritless, dull monotony, and with little beneficial result.

Average Mathematical knowledge at that period.

Question 20. What was the usual amount of mathematical knowledge possessed by Officers on joining this course during your connexion with it?

It varied according to the time Cadets remained at the Academy, which depended on the demand for Commissioned Officers in the corps. About the year 1804, when I got my commission, mathematical knowledge was at a low ebb. Amongst the professors at the Academy there were great mathematicians, but they were bad teachers. The average amount

of mathematics with which an Officer joined the regiment at the date I have mentioned, was as follows:—A *superficial* knowledge of Arithmetic, and of Algebra, as far as Quadratic Equations inclusive; the use of Logarithms; of Geometry, as contained in Dr. Hutton's course; and Plane Trigonometry, with its application to the measurement of heights and distances.

Question 21. What in your opinion is the proper amount of mathematical knowledge which should be possessed by a young Officer on joining the regiment?

Amount of Mathematics necessary.

I consider a thorough instead of a superficial knowledge of the amount of mathematics stated in the answer to the last question as amply sufficient to meet all cases that are at all likely to occur in the career of an Artillery Officer, with the addition of Conic Sections.

With this as a foundation, should he have a decidedly mathematical turn, he will soon extend his researches to the higher branches of the science; but although a few mathematicians of a high order may be very useful to the corps, still it is by no means desirable that this should be general, because it may become a passion, absorbing the thoughts and withdrawing the attention from the various important practical duties of the service.

Question 22. Without reference to what may be the present state of teaching, what do you consider the education, both scientific and practical, which would most completely qualify an Officer of Artillery for the discharge of his various duties?

Without entering much into detail, I shall endeavour to state the general principles which appear to me most conducive to a good system of Artillery education.

Admission of Cadets to the Academy.

Between the ages of sixteen and eighteen.

Qualifications for the Academy.

Before admission, they should undergo a strict and conscientious examination in the following branches of knowledge:—

A sound knowledge of the English language, and to be able to write a good and legible hand.

A fair knowledge of general history, ancient and modern, and more particularly of their own country.

To be able to write and speak the French language with ease and fluency.

To be well grounded in Arithmetic, and in Algebra, as far as Simple Equations inclusive; in Plane and Solid Geometry; in Practical Geometry and the use of drawing instruments; in Plane Trigonometry and its application to the measurements of heights and distances; in Physical and Political Geography.

No payments after admission.

When the Cadet has passed a satisfactory examination, and has been admitted to the Academy, I consider it just that his parents should be exonerated from all further expense. By the present scale of payments, 125*l.* per annum are charged for Cadets, the sons of private gentlemen, not being Officers in the Army and Navy. This regulation excludes from the service all young men whose parents are not at least in easy circumstances, and consequently has the bad effect of diminishing the number of candidates, and therefore the chances of getting young men of superior ability. It would, however, be advisable that a certain sum should be deposited by the parents of the Cadet, to be forfeited if he should be dismissed from the Academy for misconduct, as in that case the State would be a loser. The deposit to be returned to the Cadet's parents when he receives his commission.

Numerical Strength of the Establishment.

This will depend on the exigencies of the service. For my present purpose I shall suppose the number to be 200, and divide them into four classes of fifty each, and that four years of academical education are required to enable the Cadet to pass his examination for a commission in the Corps of Artillery. I shall conduct one class through the course as a means of pointing out what I think the Cadet ought to be taught.

MAJOR CHARTERS, R.A., H.P.

Four years' course of instruction.

Instruction.—First Year.

1st. From the 1st of April to 1st November.

7 A.M. to 9 A.M. Military Exercise.
9 „ 11 „ Mathematics.
11 „ 12 „ Military Equitation.
1 P.M. to 2 P.M. Dinner; at this hour during the whole year.
3 „ 5 „ Drawing.
5 „ 6 „ Sword Exercise and Fencing.

Military Exercise.—Until the Cadets be well advanced in company drill and the manual and platoon exercises, two hours a day may be devoted to them. When they have made considerable progress in these, they may commence gun drill on alternate days, continuing the small arm drill on the others.

When the class has acquired facility and dexterity in the manual operations appertaining to the service of the guns, each Cadet in his turn will be made to conduct the drill under the eye of the instructor, and he will go through all the directions and instructions as if he were teaching recruits, and the same system will be adopted in the infantry drill. Nothing so completely renders a person master of a subject as explaining it to others, and this mode ought to be resorted to, in all cases where it may be applicable.

When sufficient progress shall have been made in these exercises, the two hours may be frequently devoted to target practice, at different ranges, with guns and small arms.

Mathematics.—Although I believe the portion of mathematics which I have suggested for the examination of the Cadet on his admission is sufficient for all useful purposes, still two hours a day may be devoted to this subject during the first year, with the view of not only securing what the Cadet brought with him, but of somewhat extending it. A great deal of valuable time used to be lost formerly by the mode of teaching. Long calculations of figures, requiring hours to perform, were insisted on, which, after all, were nothing more than additions, subtractions, multiplications, &c. It is sufficient that the learner know how to perform them; the performance is pure waste of time. Let him be able to explain principles thoroughly, and the object will be gained.

Military Equitation.—Considering how much of an Artillery Officer's duty is performed on horseback, it is a point of primary importance that he should be a good horseman. During the first year this may be confined to riding-school instruction, into which may enter a little squadron drill.

Drawing.—For the first year two hours a day may be occupied in learning to draw the human figure, on a large scale. This will facilitate the acquisition of all other kinds of drawing. It is of great importance that an Officer should have the free use of his pencil, and I know of no better way of acquiring it than that which I suggest. Unless he have a natural taste for drawing he will never become an artist, but by perseverance enough may be gained to be very useful.

Sword Exercise and Fencing.—In order to acquire dexterity in the use of the sword much practice is necessary, but it is right that an Officer should be master of the weapon he wears at his side. This exercise gives grace to the movements and agility to the limbs, and I recommend that it should be continued, at least at intervals, during the whole four years' course.

From 1st November to 1st of April.

The short daylight and the inclemency of the season will render necessary some modification in the distribution of time. Military exercises in the open air will be frequently interrupted, but when these cannot be practised more time may be given to study, and to exercises under cover. During the winter months there might be lectures for two hours every evening on general history.

It will be observed that during the summer season there will be several hours of the day at the Cadet's own disposal. It is desirable, however, that this time should not be consumed altogether unprofitably. Few things will be found of more practical utility to an officer than the power of judging distances correctly by the eye, and the Cadets should be encouraged to practise it as a pastime.

Second Year's Instruction.

From 1st April to 1st November.

Field Battery Exercise, two hours three times a-week.

Marching Drill with Small Arms, Target Firing, two hours three times a-week.

Plan Drawing, two hours three times a-week.

Fortification and Artillery, two hours three times a-week.

Squadron Drill, one hour three times a-week.

Sword Exercise and Fencing, one hour three times a-week.

Experimental Physics, two hours every day.

Laboratory Course, one hour every day.

Field Battery Exercise.—For this purpose, a field battery of four light six-pounders will be stationed at the Cadet barracks, and a sufficient number of men to take care of the horses, harness, &c.

At exercise the guns will be manned and driven by the Cadets, changing rounds frequently, so that each may have his turn in the different operations. They will be taught to clean the horses, feed and litter down, to harness and unharness, in short to perform all the duties of gunners and drivers. Instead of throwing away ammunition by firing blank cartridge, the field battery might manœuvre against a line of targets, placed before the butt, firing shot at them, many of which might be recovered.

Marching Drill.—During this second year the Company may be instructed in light infantry movements.

Plan Drawing.—The instructor will not be satisfied, as formerly used to be the case, by merely giving plans to be copied. He will explain the principles on which every part of this drawing is founded.

Fortification and Artillery.—As this course will be continued through the other years, it is recommended that the history, the progress, and the principles of the science be fully entered into and carefully explained. In these explanations, the adaptation of works to the nature of the ground will be particularly shown. The principal fortresses in Europe will be described, their strong and weak points explained. This lecture on fortification will occupy a portion of the two hours, the remainder will be devoted to laying down on paper the various parts in plan and profile.

The same system will be followed with respect to Artillery.

Experimental Physics.—The details to be gone into in this course will be regulated according to the time afforded, viz., three years, but two hours a-day only for the first two years.

Laboratory Courses.—This will comprise the mode of preparing and the manipulation required in making the various military fireworks, the preparation of gun and small-arm ammunition, the mode of manufacturing gunpowder on the large scale; also the way of producing it in small quantities in cases of necessity.

From 1st November to 1st April.

Plan Drawing, two hours three times a-week.
Fortification and Artillery, ditto ditto.
Military Exercise, when weather permits.
Military Equitation and Fencing, alternate days.
Experimental Physics, two hours every day

During the winter months there might be a lecture for two hours every evening on Strategy and Tactics, or the Science of War on the great scale, as exemplified by the operations of illustrious commanders, ancient and modern. This subject is now (as it always ought to have been) of the greatest importance to the Officers of Artillery, because they having lately had the good fortune to be placed under the War Department, it is to be hoped that the time is at last arrived when they will have an equal chance with the Officers of the other Arms of Her Majesty's Troops to be selected for general commands. I suggest that these lectures be continued in the winter season during the whole of the remaining course.

MAJOR CHARTERS, R.A., H.P.

Four years' course of instruction.

Third Year's Instruction.

1st April to 1st November.

Practical Geometry on the Ground, two hours three times a-week.
Perspective Drawing, two hours three times a-week.
Fortification and Artillery, ditto ditto
Riding and Fencing, one hour alternate days.
Chemistry, two hours every day.
Experimental Physics, two hours every day.

Practical Geometry on the Ground.

This will comprise the mode of tracing and constructing batteries, fieldworks, &c., and the Cadets will perform the manual labour required in these operations.

Perspective drawing, as applied to machines of war, buildings, &c.; and the Cadets will be taught to copy from these or from models as much as possible, a soon as they fully comprehend principles.

Chemistry.—Much attention ought to be given to this important science, and it should be continued during the whole of the third and the latter part of the fourth year.

From 1st November to 1st April.

The above-mentioned exercises, with the exception of the Practical Geometry on the ground, to be continued.

Fourth Year's Instruction.

During the summer months the class will be conducted about the country, accompanied by a camp and bridge equipage and a field battery of four light six-pounders.

It will, on this excursion, be instructed in the practice of Military Sketching, in the use of Field Instruments, in the value of Military Positions, in choosing encampments, in the passage of rivers, &c. &c.

I shall suppose it to have returned to its quarters on the 1st October.

From 1st October to 1st April.

Carriage Department and Foundry, two hours every day.
Chemistry, ditto ditto.
Instruction in Military Law and the practice of Courts-martial, one hour three times a-week.
Repetition of mathematics, as a preparation for the approaching examination, two hours daily.
Experimental Physics, two hours daily.
Evening lectures on Strategy and Tactics.

It may be objected that, in the foregoing sketch of Artillery education, I have embraced too many subjects, the acquisition of which in the time allowed would be beyond the powers of the highest talent; and this would be quite true if study was to be given up when the Cadet left the Academy. I consider the object of school education to consist in preparing the youth for future study, in pointing out the paths leading to knowledge, and inducing him to continue in the pursuit of it.

The object of an examination is to ascertain whether the Cadet really understands the principle which the question involves, and can explain the mode of operation, to arrive at results. A trifling defect of memory, probably produced by the occasion, is no reason for rejecting him. If, however, he fails after several repeated trials, and after a fair time has been allowed him for collecting his thoughts, and it is apparent that he has not acquired the proficiency he ought to have done, he should then be turned back for another year's study.

(Signed) SAMUEL CHARTERS,
Captain, R.A., H.P., Brevet Major.

From Captain Younghusband, R.A., Secretary to the Royal Artillery Institution, Woolwich.

Captain Younghusband, R.A.

Sir, Woolwich, April 29, 1856.

I have the honour to enclose my replies to a series of questions addressed to me by the Commissioners for reporting upon the education of the Scientific Corps.

I have, &c.
(Signed) C. W. Younghusband.
Captain Royal Artillery.

A. H. Clough, Esq.,
Secretary to the Commission.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Artillery, after joining their respective Corps?

No instruction given to Officers until 1850.

As several changes have been made of late years, it appears desirable to give a slight sketch of the system hitherto pursued.

Up to the year 1850, Officers, after joining the Royal Artillery from the Royal Military Academy, which at that time was the only source from which the regiment was supplied with Officers, received no professional instruction whatever. Second Lieutenants were required, by the standing orders of the Regiment, "to attend sedulously to their professional studies, and to report "weekly to the Commanding Officer the nature of each day's study or occupation." The nature of study was thus left to the choice of the young Officer himself, and practically, no compulsory study existed but in form.

Course of instruction under the Director of Studies.

In 1850 commenced the system of placing Officers, on first joining the corps, under a Director of Studies. The course of study comprised Military History, Tactics, and Strategy; and as the class books on these subjects were principally French and German, opportunity was thus given to keep up the knowledge of these languages already acquired at the Royal Military Academy. After a time it was found desirable to continue the Academical course of French and German. Masters in these languages were then appointed. With this exception, the whole of the training of the young Officers devolved upon the Director of Studies. Instruction in military duties comprised drill of the several kinds, explanations of the Articles of War, Military Law, forms of Courts-martial, and the various forms of reports used in the ordinary duty of a subaltern Officer.

It may be mentioned that a sum of money (400*l.* annually) is granted for defraying the travelling expenses of a portion of the young Officers, who, it was proposed, should visit, with the Director of Studies, celebrated fortresses, fortifications, and arsenals on the Continent.

Duration of the course.

The whole period during which each batch remained under the Director of Studies was six months, after which each Officer joined his Company on home or foreign service.

This system was broken through at the commencement of the war, on account of the demand for Officers, and for an interval of about twelve months the office of Director of Studies was vacant. It was re-established in July 1855, with a staff, on a much more extended scale than heretofore.

Present staff of instructors.

Under the Director of Artillery Studies, there are now two Captains of Artillery as First and Second Instructors in Military Exercises; the French and German Masters (as heretofore, but giving a longer attendance); an Instructor for Surveying; an Instructor for Military Drawing, &c.; a Lecturer on Natural Philosophy and Mechanics.

At the present time (April 1856), the second batch is undergoing instruction in this department. Both the present batch and the batch preceding it were composed of gentlemen who had not passed through the Academy; a large portion of time is therefore necessarily devoted to elementary drills, which are thoroughly learnt by Cadets before leaving the Academy. None of the young Officers who have obtained commissions from the Academy have gone through this course.

It will be seen from the foregoing sketch, that, at most only the latest joined Officers receive any instruction or assistance in their professional studies, and that the period of instruction does not extend over six months.

CAPTAIN YOUNGHUSBAND, R.A.

Question 5. Would it be possible, and if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

More time should be devoted to the Department of Artillery Studies.

The existing Department of Artillery Studies, on its present establishment, seems to be all that is required for the instruction of young Officers after joining the Artillery; it is only necessary that longer time be allowed for instruction. Assuming that Officers provisionally commissioned in the Royal Artillery are well grounded in the various branches in which they have passed the competitive examination, particularly Mathematics, Military History, and Modern Languages, the period of instruction in the Department of Artillery Studies would be devoted, principally, to acquiring a knowledge of the practical part of their profession. Besides the simple and ordinary forms of drill, a competent knowledge ought to be acquired of the manufacture of all Artillery matériel, a sound knowledge of gunnery, considerable practice in the use of ordnance of all natures, and in the various mechanical methods employed in manœuvres with heavy guns. It is evident that all this cannot be acquired in so short a time as six months. A period of two years would be required for the course above indicated to be satisfactorily completed.

The question proposed hinges, however, to a considerable extent, upon the acquirements already possessed by the Officer on joining the corps. If the age of admission to the regiment be of the age of from seventeen to twenty, and the newly-commissioned Officer has proved, by the result of his examination, that he has received a sound general education, such as we know the large public schools of England can give, no better foundation can be desired upon which to graft a purely practical course. The case would be different if the previous education had not been thoroughly sound and good.

Question 6. Does any institution for Officers in the Artillery, similar to the Senior Department at Sandhurst, appear to you to be desirable?

The advantage of a Senior Department cannot be over-estimated.

The advantage to the Artillery of an institution similar in principle to the Senior Department at Sandhurst, cannot be over-estimated. The period at which an Officer first joins the corps from the Academy, where he has been subjected to strict discipline and a very laborious course of studies comprising a great variety of subjects, is not favourable for requiring of him a continuance of study. There are many essential points of his profession to be learnt; but, on the whole, he is ill inclined to give his mind earnestly to it. A civilian, entering for the first time upon military life, finds so many things of novelty and interest, that he is more inclined to set to work to learn the duties of his profession; but in both cases some practical experience by the individual himself of his own deficiencies, is of immense service. It would be a great advantage to allow him to enter upon his military duties for a certain period, say about three years, and then, after he has discovered his own defects, give him the opportunity for study.

Utility of a previous period of military service.

It does not seem desirable, at this time, to enter into details respecting the course of study which should be pursued at a Senior Department; it may, however, be remarked that no Officer should be admitted who has not actually performed at least three years' actual regimental duty, and who cannot prove, by examination, that the interval which has passed since he joined the corps has not been misapplied. Periodical examinations should be made of the Officers studying, and any one who does not make satisfactory progress, immediately sent back to the regiment. In fact, every care should be taken that the time and opportunities given for study should be earnestly devoted to it. On the other hand, the Officer should be relieved from all regimental duty, and arrangements made which will not render him liable, under any circumstances, to be sent back to his company.

Periodical examinations in the Senior Department.

Feeling in favour of a Senior Department amongst Officers of the Corps.

It may be added, that the establishment of a Senior Department for the Royal Artillery has long been wished for by Officers of the corps, who, feeling a strong desire to study, have been denied the opportunity (the Senior Department at Sandhurst not being open to them). The Royal Artillery Institution, commenced by the private exertions of some Officers of the corps, has received considerable assistance from Government, but is supported almost entirely by the voluntary subscriptions of its members, which include nearly every Officer in the corps. It has long been hoped that this institution, where at present Officers in the garrison at Woolwich have an opportunity of attending classes

and lectures during the intervals of their regimental duty, would eventually furnish the means of enabling a certain number of Officers, who should be relieved from regimental duty, to go through a special course of study. CAPTAIN YOUNGHUSBAND, R.A.

Questions 7 and 8, bearing principally on the same subject, may be taken together.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Artillery in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

The duties of Artillery Officers are very multifarious, and are not in all cases clearly defined. "Artillery duties in garrison" are laid down in the standing orders of the regiment. They relate to the general charge of all the ordnance on the works, with all the ammunition and stores appointed for this service; the division into districts, and the nature of the inspection required of each Officer to insure that everything under his charge is in perfect order, and in readiness for immediate service. Artillery duties in the field, and during the operations of a siege, are not defined. By the existing system, it is assumed that every Officer is competent to undertake either field or garrison duties, whichever he may be called upon to do; or practically, according as he may happen to fall by promotion or otherwise. It thus frequently happens that an Officer succeeds to the command of a field battery without having had experience in duties of this nature during the whole of his previous service.

Field and siege duties not defined.

It is very desirable that some reorganization of the Artillery service should be effected, so as to assign permanently to each Officer either field or garrison duties. Should this be done, the addition that might "advantageously be made to the duties at present assigned to Officers in the Artillery," is, in respect to siege operations, after the object for which batteries to be erected is agreed upon, to decide upon their position, extent, and armament; to superintend and be responsible for their construction. At all times, and under all circumstances, the Artillery Officer should control the construction of cover for his men and guns. Respecting permanent works of defence, the Artillery Officer, having, in conjunction with the Engineer Officer, determined upon the position and nature of the works to be erected, should alone decide upon the number, nature, and position of the guns to be mounted, the platforms required, the position of the magazines, storehouses, &c.; and he should be required to state all that is necessary to render the service of his guns the most effective possible. The Engineer Officer should then carry out the requirements of the Artillery Officer. The guiding principle throughout, in apportioning the respective duties of the two services, should be, that the Artillery Officer decide alone upon all he requires for his own arm, and the Engineer Officer carry out the requisitions made upon him.

Either field or garrison duties should be assigned permanently to each officer.

Respecting the latter part of Question 8, the meaning is not very clear; but so far as regards the education together of candidates for the two corps of Artillery and Engineers, it cannot but be most prejudicial, as well to the Artillery as to the public service, and this will always remain so, so long as the advantages of pay are as great as at present on the side of the Engineers.

Disadvantages of united education for the two corps.

It would not be difficult to show that the important duties of Artillery Officers, to be efficiently performed, require the best men the country can afford for military service; but if candidates for the two corps are educated together, and the most talented, by gaining an advanced place among his competitors, can choose the corps in which he will hereafter serve, it is evident that, in the majority of cases, he will choose the one which offers the highest advantages, and that the Engineer corps will obtain the best officers, at the expense of the Artillery. The public service also suffers, because it may be safely asserted that the acquirements of an Artillery Officer ought to be, at the very least, as high as those of an Engineer.

On the side of educating together candidates for the two corps, there does not appear to be any advantage whatever. The universities and public schools of

CAPTAIN YOUNGHUSBAND, R.A.

Great Britain can furnish as good a general education as could be desired. What is required, in addition, is a Practical Course, and, for the sake of the knowledge which it is desirable the Artillery Officer should possess of Engineer duties, or an Engineer Officer of Artillery duties, it seems very unadvisable to continue the education of candidates for the two corps together. The Practical Course of each would be better pursued in separate establishments.

Inducements to the candidate to prefer the Engineers.

The inferiority of Artillery pay, as compared with that of the Engineers, is, if admitted, not always understood to the full extent, and perhaps may properly be here adverted to.

The Artillery Officer, in addition to the prescribed pay of his rank, is allowed a soldier servant (to whom he pays wages), a quarter (one room, if below the rank of a Field Officer), and fuel (for ranks below that of Field Officer, commuted, when not received in kind, at 2*s.* 6*d.* a-week).

The Engineer Officer, in addition to the prescribed pay of his rank, is allowed 1*s.* 6*d.* a-day in lieu of a soldier servant, and half the pay of his rank in lieu of a quarter and fuel; if provided with a quarter, a small deduction is made. On foreign stations, active service, and in the London District in England, the pay, instead of being one and a-half the fixed rate, is doubled.

It is thus evident that the young Engineer Officer, on joining his corps, has great pecuniary advantages as compared with the Artillery Officer. These advantages increase very greatly as the Officer advances in the service, the one and a-half or double pay then making the difference considerable. Besides, if the Artillery Officer be married, his allowance of a quarter is generally valueless. There are very few stations in which a married Officer can live in the quarter allotted to him; he has no allowance, and must provide a residence at his own expense.

All these are considerations which influence the candidate for a commission and his friends in making a choice. The argument for inferior pay to the Artillery corps can only be supported on the ground of its duties being less onerous and responsible. To say the least, this a glaring fallacy.

The education common to both corps to be obtained at the Universities and public Schools.

Question 9. Do you think it would be more advantageous to the Public Service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive Examination,) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

As it appears to be now determined that Officers for the Artillery and Engineers should be selected by means of a public competitive examination, it only remains to decide in what manner this may best be carried out. I have before expressed an opinion that the universities and public schools of this country can be safely looked to for providing the corps with Officers having a sound general education; and if the system were finally settled and made known, greater attention would be given to mathematics and the natural sciences in preference to classics. No doubt, also, were the examination such as to require it, a more specific military education would be given in large schools to those pupils who looked forward to the army as their future profession. At King's College, and elsewhere, a Professor of Military Art has been appointed.

The candidate, of the age of seventeen to twenty, having passed his examination, should then, I think, be received, if for the Artillery, at an Artillery College, if for the Engineers, at at an Engineer College; and the course in both should be principally practical, with a view to the respective duties of the two corps. The course at present designed for the department of Artillery Studies, would, I think, if thoroughly carried out, complete the education of a young Artillery Officer. It would probably be advisable to continue the study of mathematics, both pure and applied. Chemistry should not be neglected, but the course would require to be reconsidered and modified to meet the required conditions.

(Signed) C. W. YOUNGHUSBAND,
Captain Royal Artillery.

From Captain Boxer, R.A., Superintendent of Royal Laboratories, and formerly Instructor in Practical Artillery. Capt. Boxer, R.A.

Sir, Royal Laboratory, June 11, 1856.

In reply to your letter of the 11th March 1856, I have the honour to inform you that I think it desirable to reserve my opinion upon matters connected with the education of Officers of the Artillery and Engineer Corps until I am called upon to state my views with reference to the subject as a member of the "Committee appointed to report upon the Proposed Alterations in the "Royal Military Academy at Woolwich."

I have, &c.

A. H. Clough, Esq., Secretary, &c. &c.

(Signed) E. M. Boxer,
Captain Royal Artillery, Superintendent Royal Laboratory.

REPLIES FROM OFFICERS OF THE ROYAL ENGINEERS.

From General Sir John F. Burgoyne, Bart., G.C.B., R.E., Inspector General of Fortifications. General Sir J.F. Burgoyne, Bart., G.C.B., R.E.

Sir, War Department, Pall Mall, April 10, 1856.

In reply to the printed circular, dated Metz, 11th March 1856, on the subject of reorganizing the system of training Officers for the Royal Engineers, I beg to submit a few remarks that occur to me; but if the object of the inquiry is founded on the assumption that there is, at this particular time, a great necessity for radical changes, because the Officers of the corps have been found generally unequal to their duties in consequence of defective education, I cannot admit it; at the same time, I am quite alive to the propriety and advantage of making successive improvements in that, as well as in all other institutions, to meet the progress of knowledge that time is constantly producing.

Importance of Military Academies.

A principle has been partly introduced of obtaining candidates for commissions in the Engineers from private life; their education to be acquired anywhere. This might have the effect of leading to (what is indeed advocated as judicious by many) the suppression of the Military Academies of the service—a system to which I can by no means assent. I consider the Military Academies by far the best principle for the education of young Officers for the last two or three years before obtaining commissions. There can be no reason why they should not be on the best possible system for education and moral control; their proceedings can be narrowly watched, and they possess the very great advantage of inculcating military habits and knowledge, drill and exercises, &c., imperceptibly as it were, and at a period when they are easily learned in perfection, and in a manner that leaves a lasting impression. The principle, I maintain, is good, and therefore, if there be any defects in the practice, let those defects (which cannot escape notice and publicity) be amended, and not made the ground for the abandonment of what is correct in system.

Objections to throwing open Commisions to public competition.

Nor can I concur in the mode of giving commissions by occasional trials of educational acquirements, tested by public competition.

In the first place, it is not found by experience that all, or even any large proportion, of those who at a given comparatively early age, have made the greatest progress in certain specific branches of knowledge, maintain a pre-eminence as Officers in after life; then the duties of even Officers of Engineers do not require exclusively those precise qualifications, and although a certain definite proficiency is necessary, the high attainments that would give the first stations are not so. Then, competition leads to a great amount of chance: a young man may be rejected with one set of competitors who might stand high with another; thus at the military establishments, while great encouragement should be given to progress in studies, those who reach a minimum of what is considered absolutely necessary, if combined with other good qualities, should be received.

I have, &c.

A. H. Clough, Esq.

(Signed) J. F. Burgoyne, Lieutenant-General,
Inspector-General of Fortifications.

GENERAL SIR J. F. BURGOYNE, BART., G.C.B., R.E.

Ordinary duties of Engineer Officers.

Question 1. Will you have the goodness to supply the Commission with an account, in as much detail as you think fit, of the usual duties belonging to Officers in the Engineers, in time of war and of peace, at home and on foreign service, which must be considered in reference to their education?

The duties to which the attention of Officers of Engineers may be required are very multifarious; their ordinary practical duties partake usually of those of civil engineer, builder, and surveyor, as applied to military objects, in the design of which military considerations must enter.

Qualifications for the first institution.

As regards their education, the principal qualifications for the first institution are mathematics, arithmetic, geometry, drawing, and the French and German languages—the French in particular; writing a good hand is very desirable, and being of easy acquisition, should be enforced.

For the second.

For the second institution, the study of the practical and theoretical military knowledge and exercises applicable to Engineering, with lectures on Chemistry, Geology, &c., that will afford a slight general knowledge on those subjects, useful to all; every opportunity being given to those who may wish to make any one branch a particular object of inquiry.

Average number employed on civil services.

Question 2. Can you give an idea of the average number of Officers in the Engineers, employed on duties of a not strictly military character?

About twelve Officers of Engineers may be considered to have been employed generally in other Government services than those of their corps.

The latter not to be taken into account with a view to education.

Question 3. In reference to question No. 2, do you think that all these duties should be considered, or that any of them should be omitted from consideration, in the instruction given to Officers of the Artillery, *or* of the Engineers?

These services are so various and so uncertain, that I cannot conceive it to be desirable to take them into account in the consideration of the education for the corps.

(Signed) J. F. BURGOYNE,
Lieutenant-General, and Inspector-General of Fortifications.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective Corps?

The Officers of Engineers, on first obtaining commissions, attend the Institution for Practical Exercises at Chatham. Information on its nature, and on the improvements of which it may be susceptible, can be best obtained from Officers who are there at present, or who have been attached to the institution, in charge of the several objects of pursuit; as well as from some intelligent Officers, who have more recently left it, but of sufficient subsequent experience to be able to form a judgment on the subject.

The whole of the practical knowledge necessary is not to be taught at institutions.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

A great deal of practical professional knowledge is very necessary to an Engineer, in addition to what he can obtain by any educational system; and this can only be well acquired by attending to the practical operations, as carried on for actual use: any attempt to teach them at colleges or institutions would be fallacious. It would be desirable to encourage and facilitate the study and acquisition of this species of knowledge in the younger Officers in particular, making it a point to ascertain and report their progress; so that, in fact, the study and improvement in professional knowledge would be an element in their duties, even after they had quitted the restraint of the more formal instruction.

A Senior Department in addition to the establishments at Woolwich and Chatham not desirable.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

If by a similar establishment to the Senior Branch at Sandhurst is meant an additional institution to those at Woolwich and Chatham, I cannot think it would be desirable; if there is any useful knowledge acquired at Sandhurst, and not in the course pursued at those establishments, it had better be introduced at the latter.

GENERAL SIR J. F. BURGOYNE, BART., G.C.B., R.E.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

Advantages of employment in time of peace on constructive and scientific designs and operations.

Every part of the duties of an Engineer in the field depends essentially on the arts and operations, constructive and scientific, that are in constant use in civil life and in peace. The more, therefore, that Officers of this corps can be charged with the designing and practising of those arts and operations in ordinary times, the more competent they will be for the various calls that may be made upon them in war. The drills and exercises for the ordinary military duties of an Engineer in the field are of easy acquirement; but occasions are numerous where the Officers may be of great service by having a good knowledge of constructive, geodesical, and other arts and sciences.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

The union of the two corps would be ruin to the service, though their elementary education might be combined.

I cannot comprehend the full tenor of this question; a union of the two corps of Artillery and Engineers would be preposterous, and utter ruin to the service.

The first elementary education for both may be well combined, as it is at Woolwich Academy; but it is understood that the Artillery object to it, as tending to give the Engineers a preference in selection from the candidates, by which, practically, however, I am not aware of their having gained any advantage. I cannot bring to mind any case where any readjustment of functions would be at all desirable; certainly no propositions of the kind that have come to my knowledge appear to me to be so.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

For each corps there should be but one subsequent institution.

Having attained the first degree of elementary knowledge that is of a general character, I would have one only subsequent institution—call it Practical Class College, or anything else—where practical and scientific knowledge, drawing, modern languages, &c., should be pursued; but in all adapted and directed peculiarly to the precise duties and functions of the corps. I think it of advantage to have the educational establishments at military stations, and so near to London as to be able to obtain ready communication with, and co-operation from first-rate lecturers and men of knowledge; and that the second institution for the Engineers should be where there may be permanent fortifications.

Choice of situation.

(Signed) J. F. B.

Question 10. As the result of your observations in the Crimea, would you say that in any points of practical or scientific knowledge, the education of the Officers of Engineers is susceptible of improvement?

I am not aware of any occurrence, or the performance of any duty in the Crimea, that exhibited a want of practical or scientific knowledge on the part of the Officers of Engineers; but it is impossible to say whether any increased knowledge on their part might not have led to some useful results.

Question 11. Can you make any suggestions with this view for the

It is so many years since I had any intimate knowledge of the teaching at

General Sir J. Burgoyne, Bart., G.C.B., R.E.

improvement of the teaching now given at the Academy at Woolwich?

Woolwich Academy, that I am unable to answer the question regarding it; but there are many officers of intelligence who are fully competent to report upon the subject.

(Signed) J. F. B.

Major-General Sir H. D. Jones, K.C.B., from R.E.

From Major-General Sir Harry D. Jones, K.C.B., from R.E., Governor of the Royal Military College, Sandhurst, and formerly Director of the Royal Engineer Establishment, Chatham.

Education of Engineers not sufficiently practical.

Question 10. As the result of your observations in the Crimea, would you say that in any points of practical or scientific knowledge, the education of the Officers of the Engineers, as at present conducted, is susceptible of improvement?

The result of my observations in the Crimea is, that the education of the Officers of Engineers, as at present conducted, is susceptible of improvement; it should be more practical.

Question 11. Can you make any suggestions with the view for the improvement of the teaching now given at the Academy at Woolwich?

Not being sufficiently acquainted with the mode of teaching at the Academy at Woolwich, no suggestions are offered.

Question 13. What, in your opinion, is the amount of mathematical knowledge which, according to the usual system (as pursued prior to the war), is requisite for passing with advantage through the course of study followed at Chatham?

The amount of mathematical knowledge, according to the system pursued prior to the war, is sufficient for passing with advantage through the course of study followed at the Royal Engineer Establishment, Chatham.

The extent of instruction possessed on joining at Chatham is sufficient.

Question 14. Do you consider that Officers are sufficiently instructed when they join at Chatham, either as regards the extent or the depth and accuracy of their knowledge, to enable them to follow the course with full advantage?

Officers who join at Chatham, after having passed through the Royal Military Academy and the Practical Class at Woolwich, are sufficiently instructed, as regards the extent of knowledge, to enable them to follow the course with full advantage. As to the depth and accuracy of their knowledge, no general answer can be given; the questions can be answered only with reference to each Officer, the depth and accuracy of knowledge varying with each individual.

Subjects which should be added to the course.

Question 15. Are there any subjects not at present taught at Chatham which you think should be added to the course? can you or suggest any improvement in the general mode of instruction pursued?

Architecture, Mineralogy and Geology, Military and Landscape Drawing and Sketching, Mechanics, Hydrodynamics, Railways, Steam-engines of various descriptions, and Machinery; also a Laboratory course.

As to the latter question, the Chatham course may be considered too much of an educational nature, and not sufficiently practical.

Question 16. In case of such improvements being effected, what additional amount of previous mathematical knowledge would become requisite?

None; if well grounded in all the branches of it, to the extent professed to have been acquired.

Question 17. Without reference to what may be the present stute of teaching, what do you consider to be the education, both scientific and practical, which would most completely qualify an Officer of the Engineers for the discharge of his various duties?

The duties which Officers of Engineers are called upon to perform are so numerous and so varied, that it is extremely difficult to define what the education, both scientific and practical, should be, to qualify an Officer of Engineers for the discharge of his various duties.

Science, to what extent required.

General science, in a very extended sense, is most necessary and important

for an Engineer Officer, and a practical acquaintance with almost every subject embraced under this head. Mathematics, beyond a certain degree, is not necessary; to that point every person may be beneficially instructed; but no individual can be made a first-rate mathematician unless he possesses an aptitude for the science. The higher branches of mathematics are seldom required in the practical duties of a Military Engineer.

(Signed) HARRY D. JONES, Major General.

London, April 18, 1856.

MAJOR-GENERAL SIR H. D. JONES, K.C.B., from R.E.

From LIEUT.-COLONEL LARCOM, R.E.

LIEUT.-COLONEL LARCOM, R.E.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers after joining their respective corps?

I am not aware that any assistance in their professional studies has been supplied to Officers of Engineers after joining their corps. Professional libraries have been gradually formed at the principal stations; but it has been by the subscriptions of the Officers themselves.

No assistance in their professional studies has been supplied by government to Engineer Officers after joining.

I must not be understood to attach blame to the Ordnance; scientific men and scientific studies have only very lately began to be appreciated anywhere, and, of course, in the Army last of all. Nor is even this matter of reproach, because, for the most part, other qualities are more wanted in the Army. This feeling, no doubt, has prevailed at Pall Mall as strongly as elsewhere; but the Ordnance has not been backward in affording aid to special branches of Engineer duty. I may instance the Survey of Ireland, where the Board allowed a considerable library of scientific works and works relating to Ireland to be collected for the use of the Officers; and the same may, I believe, be said of the library at Chatham, so far, at least, as allowing a room and fuel and attendance.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

Of a general nature, libraries, lectures, and well-directed travelling are, perhaps, the best aids to instruction; but you cannot enforce the use of these aids, and young men are, for the most part, idle, if left to themselves. The absence of encouragement has been a greater evil than the want of facilities. Men will always find the means of attaining knowledge if they feel that its possession will advance them. Select for superior duties Officers who distinguish themselves by superior acquirements, and take care to reward them when they succeed, and you will soon have high attainments. It is to this practice, which has gradually become more and more acted on, especially within the last few years, that the rising standard of Engineer Officers is due. I venture to think the publication of professional papers, first began by Sir William Denison, one of the most useful things in this direction which has occurred in the corps in my time. Besides making the experience of each available to all, it creates a public opinion, enables Officers to appreciate each other, and brings them under the notice of the heads of the corps.

Advancement an incentive to study.

Professional papers.

(*See* also answer to next question.)

Question 6. Does any institution for Officers in the Engineers similar to the Senior Department at Sandhurst, appear to you to be desirable?

It would, I submit, be desirable to give Chatham somewhat of this character, not only by carrying forward the scientific instruction of the young Officers to a higher point than that at which they leave the Military College, but, by encouraging Officers, on returning from foreign service, to go there and revive their practical knowledge, and witness and assist in the application of science to practical purposes. They would not only improve themselves, but would bring with them the results of their own experience for the general good. Little more would be necessary than to give them rooms and home allowances, without requiring routine duties from them. Officers of Engineers are now too constantly employed; they have no leisure for improvement. I would require careful reports from them, the preparation, perhaps, of papers like those in the

Senior Department might be formed at Chatham for Officers returning from foreign service.

Reports, &c., to be required of them.

LIEUT.-COLONEL LARCOM, R.E.

Memorial du Depôt de la Guerre. Sir William Reid laid the foundation for something of this kind when he was at Chatham; I do not know whether it has been followed up.

Civil duties, which are not professional, not to be permanently thrown upon the corps.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

This is too general a question to answer definitely; but as there is scarcely any duty of a scientific or practical nature, which an Officer of Engineers may not be called on to perform in time of war, so there are few such the performance of which during peace may not be a means of extending and continuing his efficiency. During the late long peace, Officers of Engineers have been employed on duties of all kinds for the general government, and it cannot be doubted their capabilities have been thereby greatly improved. It is reasonable to suppose they have been useful in those employments, or the practice would not have extended as it has done. I hope this system will be continued, in the colonies as well as at home; but while I think individual Officers may be so employed with advantage to the public as well as to themselves, I doubt the wisdom of adding permanently civil duties to the Engineer Department, except such as are purely professional, like national surveys. Wherever, indeed, large numbers of men are required, military organization is essential, and if the state had undertaken railways, as was once contemplated, the Engineer Department would have been the proper executive body; but this is not the English system, and it is not desirable so to systematize as to lessen the stimulus to individual enterprise, which the prospect of great gain holds out to private capital and talent. I believe the building and charge of barracks has been useful to the corps, by furnishing much useful detail experience, and valuable habits of business; and if the Officers had not been crippled in their estimates, they would have erected very perfect military accommodation, perhaps even more so if barracks were considered as military posts and cantonments instead of mere caravanserai. I remember hearing this observation made by a great man now no more—the late Sir Charles Napier.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

I fear I do not understand this question, and therefore cannot undertake to answer it. The functions of the Engineers are as different from those of the Artillery as they are from those of any other branch of the military service, and the "union of the corps of Artillery and Engineers" as impossible as the union of Cavalry or Infantry with Engineers. The duties of Engineers are general, those of every other arm are specific. I really do not understand the question.

Military College for all arms, and subsequent Schools of Application for each.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a practical class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

The true solution of this question is, I think, only to be found in the union of all military education in one college in its early stages, the several arms being then drafted off into special schools of application. I see no reason for combining the education of Engineers with that of the Artillery in particular. Formerly, they were called "The Scientific Corps," and there was special education for them, and for no other part of the army; but now, that special education is deemed necessary, to a certain extent, for the whole army, as shown for many years past, by the education of a considerable number at Sandhurst, and more recently, by an entrance examination for all Officers, the several branches of the army differ in that respect only in degree, and staff duties are on all hands admitted

to be scientific. The Staff might, therefore, with advantage, be joined with the Artillery and Engineers in one college, if the whole army cannot; but if neither of these is practicable, and the Artillery and Engineers are still to be considered the only scientific corps, and sixteen is fixed as the age of entrance, still I think a Military College necessary between the original entrance examination and the School of Application. It might extend from sixteen to eighteen on an average, and at that age, or thereabouts, those destined for the Artillery might enter on their laboratory or other peculiar courses of instruction at Woolwich, and the Engineers pass to Chatham. I am satisfied, however, that Engineer instruction can never attain its full and necessary development while it is exclusively combined with that of the Artillery. Not the least of the advantages I have always anticipated from the junction of the Ordnance with the general army, is the severance of the exclusive connexion of the Engineers with the Artillery, and their more intimate union with the scientific staff of the army.

LIEUT.-COLONEL LARCOM, R.E.

Age of admission to the Military College; to the School of Application.

Objection to exclusive connection of Engineer and Artillery instruction.

(Signed) THOS. A. LARCOM.

Dublin, April 21, 1856.

From LIEUT.-COLONEL BURGMANN, R.E.

GENTLEMEN,

Guernsey, April 5, 1856.

LIEUT.-COLONEL BURGMANN, R.E.

IN reply to your circular dated Metz, March 11, 1856, relative to the best mode of training Officers for the Scientific Corps, I beg leave to make the following observations; viz., with respect to question—

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective corps?

For Officers of Engineers after joining their corps there is supplied no instruction or assistance in their professional studies, except the course of study and exercises at Chatham; and after that only the assistance to be derived from the books in the corps libraries.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

It would be very difficult to provide further instruction and assistance for Officers after joining their corps, except, as suggested, by the formation of a senior department at Chatham, which would be very desirable. Many young Officers, after a few years service, would feel their deficiencies, would better understand what they might have acquired at Chatham, and would be glad to resume their studies there. The presence of a few Officers of this description would most probably have a beneficial effect on the juniors.

A Senior Department at Chatham desirable.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

I think it desirable that candidates for the Scientific Corps, between the ages of sixteen and seventeen, should, after being selected by competitive examination, continue their studies at a Military College before proceeding to a Practical Class.

I assume that the instruction of youths is, or may be, general up to the age of sixteen; and that from that age their studies should be made to bear more particularly on their future line of life; that at the age of sixteen, therefore, there would be a selection from the greatest number of competitors, and the examination might be made comparatively severe.

Competitive examination at the age of sixteen: admitting to a Military College to be succeeded by the Practical Class.

I think it would be a benefit to the Scientific Corps, and certainly not detrimental to the general service, to allow a certain number of Cadets from Sandhurst College, who had evinced superior

Cadets from Sandhurst might compete for the Scientific Corps.

Lieut. Colonel Burgmann, R.E.

ability, industry, and steadiness, to enter the practical class for the Scientific Corps. The authorities at Sandhurst might nominate a certain number, one half of whom should be selected by competitive examination, for Artillery and Engineers. The others would enter the line, with the distinction of having competed for the Scientific Corps.

I have &c.

(Signed) Geo. H. Burgmann,
Lieut.-Colonel Royal Engineers.

Lieut.-Colonel Simmons, C.B., R.E.

From Lieut.-Colonel Simmons, C.B., R.E.

Constantinople, April 29, 1856.

Gentlemen,

I beg to transmit to you my replies to the questions submitted in your letter of the 11th March last, coupled with such observations as it appeared to me desirable that I should make.

Having been obliged by public duties to leave England, it has been impossible for me to send this reply earlier.

In transmitting my observations for the consideration of the Commission, I would observe, that they are based upon the experience obtained in the course of my public duties, which have been very varied in their nature, and in the performance of which I have frequently had occasion to regret certain defects in my own education. In the replies I have framed, I have sought to develope such ameliorations in the system now in force, with respect to the education of Officers of Engineers, as may save those who may hereafter enter the corps many such difficulties in the course of their professional career as it has been my fate to encounter, and in overcoming which I feel I should have done better for the public service if I had received a sounder and more extended practical education in Military Engineering.

I am, &c.

(Signed) J. L. A. Simmons,
Lieutenant-Colonel.

The Commission for Reporting on the Education of the Scientific Corps.

Nature of the course of instruction at Chatham. No other assistance given to study after joining.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective corps?

The instruction and assistance at present supplied to Engineer Officers in prosecuting their professional studies after joining their corps, is confined to a course of practical military engineering at Chatham, and a very limited course of architecture, with an extension and practical application of the knowledge of surveying which they have acquired at the Academy.

After completing the course of instruction at Chatham, they assume the duties and responsibilities of Officers of Engineers, acquiring such knowledge as they may from the performance of their duties, which frequently take them to and detain them in the Colonies, where they have but few books or opportunities of studying their profession in its higher and more extended branches; the whole of the military Colonies being, so far as I am aware, without military libraries or works of reference, except so far as they may have been obtained by the Officers themselves individually, or united for the purpose in mutual association.

The military Colonies unprovided with official libraries.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

It appears to be most desirable, and perfectly practicable, that further instruction and assistance should be given to Officers after joining in enabling them to pursue their studies in the higher branches of the profession.

On this subject it appears to me necessary to digress a little, and revert to the condition of Officers of Engineers when they first join the corps.

Condition of Officers of Engineers on entrance into the Corps.

They enter the corps at ages varying from seventeen to twenty or twenty-one, with an education which has been acquired either at the Royal Military Academy at Woolwich or at some other school, the extent of that education

LIEUT.-COLONEL SIMMONS, C. B., R. E.

having been tested by examination. From the nature of things, this education is only theoretical; it remains, therefore, to teach them the practical utility of what they have learnt, and the application of science to practice.

Necessity of a previous knowledge of military organization,

As they are specially destined to become Military, and not Civil Engineers, it is above all things essential, before learning the ordinary application of Science to practical Military Engineering, that they should have a thorough knowledge of military organization in all its branches, and of the use and effect of the weapons used in warfare. This knowledge is acquired to a certain extent by such Officers as have been Cadets at the Academy at Woolwich; but others, who at once gain their commissions from private educational institutions, can have but very little acquaintance with the subject.

which cannot be obtained in civil educational institutions.

Engineer Officers to be attached to regiments of the line, if possible, at a camp; and to be subsequently examined on the knowledge there acquired;

As I consider it to be above all things desirable that Officers of Engineers should be thorough soldiers, well acquainted with the peculiarities of British soldiers, and capable of distributing them at their work in a manner consistent with the ordinary formation of British troops, as also that they should understand their wants and requirements in camp and barracks, I am of opinion that very much benefit would be derived from attaching them to regiments of the line, if possible at a camp, for a period, at the termination of which they should be submitted to an examination as to their knowledge of the formation and internal organization of regiments, and the effect of the arms used by them.

They might also, with great advantage to the public service, be attached for a time to regiments of Cavalry, after which, and above all things I consider it most desirable, if not absolutely necessary to enable them to perform their duties in the field, that they should be attached to the Artillery, and go through a good practical course of Artillery, not such as is now gone through by Cadets, but more extended and perfect, attending as much practice as possible, and thus obtaining as perfect a knowledge as possible of the application and effect of artillery.

and in the same manner to Cavalry and Artillery.

Evils which have arisen from imperfect knowledge of the use and effect of Artillery.

I am induced strongly to urge this point, from the certainty I have of the very imperfect knowledge possessed by Officers as to the use and effect of artillery, which I conceive may be productive of great inconvenience, if not disaster, in the field. In fact, I believe instances are not wanting where the undue appreciation of the effect of the arms now in use has been productive of late years of very ill effects; and much of the differences of opinion which have arisen among Engineers of various countries of late years, and have led to such diversity in the construction of fortified places, arises from this cause.

Period during which Officers should be attached to the various arms.

By attaching the young Engineer Officer to the various branches of the services, for a period which, I should conceive, ought not to be less than three years for an Officer joining at once from a civil educational establishment, or than two years for one who has had the benefit of an education at a military establishment, it is to be hoped that the young Engineer would bring to his studies of practical engineering the habits and ways of thinking of a soldier, unbiassed by the prejudices of any particular arm, and that he would therefore be capable of turning the engineering knowledge already acquired or to be acquired by him to the best account as a Military Engineer.

Further examinations in theoretical knowledge before joining the Practical Class.

Before joining the establishment for practical instruction in engineering, it would appear to be desirable that he should again be carefully examined as to his theoretical knowledge, which he ought rather to have extended than otherwise during the period of his being attached to the various branches of the Army, as well as in the knowledge he has attained by being attached to those branches of the service. If found wanting in his examination, he might probably be found fit for appointment to a commission in the Infantry or Cavalry, which do not require so extensive an education.

A great advantage also, I conceive, to the practical education in military matters thus given to the young Officer would be, that he would come to learn the practical application of his theoretical science at a more advanced age, when his mind, instead of learning the practice of his profession by routine, would better appreciate the advantages to be derived from the course of study now opened to him.

Instruction in practical engineering; its present extent.

To proceed now with the subject of practical engineering, I would observe that the education is, so far as I am aware, at present confined to—

1. A knowledge of Sapping and Mining, and the practical works of a siege.
2. Pontooning.
3. A very limited architectural course.
4. Surveying and celestial observations.

LIEUT.-COLONEL SIMMONS, C.B., R.E.

To these should, I think, be added—

How to be enlarged.

1. Use of distribution of labour; construction of earthworks, &c.

First. A practical acquaintance with the employment and distribution of labour under various conditions, such as an abundance or a very reduced amount of tools, animal labour, or practical means, &c., in making field-works or permanent works, entailing large excavations and embankments in parapets and ramparts, including the application of modern science as in use in the construction of large earthworks and excavations of all sorts on railways, and in the making of docks and break-waters.

How to be learnt.

The best way of acquiring this knowledge is by practical acquaintance with the subject itself, at present only to be acquired upon the large civil works in progress in the country. As civil engineers might possibly evince jealousy in allowing Officers to visit and remain upon these works a sufficient time to allow of their becoming practically acquainted with their mode of execution, it might be worthy of consideration whether troops might not be employed, with advantage to themselves and to the country, in executing any such works that may be in course of construction in the country, or even whether it might not be advantageous on some of the waste lands adjoining some one of the permanent camps now being established in the country, to make such works, either in the shape of butts for target-practice, or entrenchments to the camp itself, and so, at the same time, to instruct Soldiers and Officers of the Army generally in that important branch of their service, without the application of which they can scarcely expect to pass through a campaign in actual warfare. It is to be observed, that a knowledge of this description of work is almost as essential to the soldier and Officer in the state to which war is now reduced as the use of the particular arm they are called upon to use.

2. Road-making.

Secondly. A practical knowledge of road-making, with a study of the materials best adapted for metalling.

3. Bridging.

Thirdly. A practical acquaintance with making both floating and standing bridges, and the adaptation of boats and materials of all descriptions to each. This would include a knowledge of the strength and application of materials under the most variable circumstances.

4. Field-sketching.

Fourthly. A far greater practical acquaintance with field sketching, including the estimation of heights and distances. Upon these sketches the student might be required to indicate the occupation of the ground either for a permanent or temporary camp, due regard being had to drainage and supply of water as well as defence, and the application of field-works to strengthen given positions.

5. Architecture.

Fifthly. It would appear advisable, if Engineer Officers are to be continued in the construction and charge of barracks, that the architectural course should be extended. On this subject, however, I speak with extreme diffidence, as my acquaintance with the course does not extend beyond the year 1838.

Course to occupy five years.

It is probable that the whole of the course here indicated, including the period of service with the various arms, would occupy nearly five years—a time which I consider not excessive to form an Engineer who shall be fit to be intrusted with such large interests as fall to the lot of Engineers in the field, with a probability of those works being executed with credit to himself and to his country, and with the utmost advantage and security of the troops and army with which he may be serving.

With this system a Senior Department would not be necessary.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

It does not seem to me that any institution similar to the Senior Department at Sandhurst will be necessary, that is, if the propositions above made be attended to.

Engineer Officers in time of peace to be employed on every kind of Government work.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

I consider that very great advantage may be derived from extending the sphere of duties of Officers of Engineers during peace.

Engineer Officers might very properly be considered as Government Engineers, to be employed upon all Government works of every nature, at home and abroad, such as docks, breakwaters, drainage, surveying, &c.

Central Board to pass the plans.

This measure would probably be attended with great saving to the country, and the works themselves would be executed equally efficiently, that is, if a

proper system were adopted by the formation of a Central Board, of high science, to approve the plans and projects; and throwing the entire responsibility of the works upon the Officers who plan and execute, and even making them responsible under penalty of professional disgrace and dismissal.

Officers to be responsible for the works executed.

The objection ordinarily made to this practice by the civil profession, viz., that it would be taking the bread in many cases out of their mouths, ought not to be listened to, for surely the country, after going to the enormous expense of educating and maintaining a number of professional men, have an undoubted right to the employment of their professional services. The true objection, therefore, hinges upon the question, whether or not a corps of Military Engineers is necessary to the Government? A question as to the reply to which I conceive there can be no shadow of a doubt.

Objection of Civil Engineers invalid.

Much benefit would also accrue to the public service if Officers were assisted in travelling to visit public works, both civil and military, at home and abroad. This assistance might be given as a reward to merit, and in all cases careful reports should be made by the Officers, from which the use they have made of the opportunities thus given to them might be judged of.

Allowances for travelling might be granted, and reports required.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

Inutility of a readjustment of the functions of the two corps.

A readjustment of the functions assigned to Officers of the Artillery and Engineers does not appear to me as likely to tend to the improvement of either. An Engineer Officer, on the one hand, ought to possess a thorough knowledge of the practical application and effect of Artillery, but it is not essential that he should have a thorough knowledge of the structure and management of horses, which is essential to the Artillery Officer, and can only be acquired by long practice in large stables; and on the other hand, an Engineer Officer requires a considerable amount of special knowledge, which can be of no practical utility to an Artillery Officer.

Desirability of a united education up to a certain point.

The union of the two corps, as a question of education merely, has always had an effect up to a certain point, and it will be seen by the extended reply I have given to Question 5, that I am of opinion that it might be carried still further with good effect, for the preliminary education therein proposed in the other arms of the service, could not but be of the greatest advantage to Artillery Officers, and the point of separation of the young Officers, and distribution to the two corps, might probably, with advantage to both, be at the period of their completion of the practical course of Artillery.

Point of separation.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

The reply to this question is given in that to No. 5.

Advantages of an extensive competition.

I would only observe, that if a system such as that I have attempted to delineate were adopted, which shall give a security that Officers of Artillery and Engineers shall, before being intrusted with the practice of their professions, become thorough soldiers, which appears to me to be above all things essential, the more extended the field of competition of admission to those corps, the greater it appears to me will be the probability of those corps being filled by members who will do credit to the duties intrusted to them, and the country they serve.

(Signed) J. L. A. SIMMONS,
Lieut.-Colonel.

LIEUT.-COLONEL M'KERLIE, R.E.

From LIEUT.-COLONEL M'KERLIE, R.E., formerly Superintendent of Surveying and Practical Astronomy at Chatham.

Dublin, May 31, 1856.

GENTLEMEN,

WITH reference to your circular letter of the 11th March last, enclosing a series of questions relative to the education of Officers of Royal Engineers previous to their joining the corps, and also to their further subsequent instruction, I beg to offer the following observations in reply thereto.

Amount of mathematical knowledge necessary in preparation for the Chatham course.

Question 13. What, in your opinion, is the amount of mathematical knowledge, which, according to the usual system (as pursued prior to the war), is requisite for passing with advantage through the course of study followed at Chatham.

In regard to the amount of mathematical knowledge, which, according to the usual system (as pursued prior to the war), is requisite to pass with advantage through the course of study followed at Chatham, I have to observe that that course being almost entirely of a practical character, in which the questions arising are usually solved by means of given formulæ, opportunities of exhibiting their mathematical acquirements are not often afforded to the young Officers; but in order that the value of these formulæ may be well understood, that errors may be avoided in their application, and that, where necessary, they may be investigated, and also that the engineering constructions, mechanical appliances, scientific instruments, and the various matters of professional interest which more or less come under daily observation may be reasoned on with that advantage which a sound mathematical knowledge alone can give, I consider it necessary that Officers on joining the Royal Engineer establishment should thoroughly comprehend Algebra, its rules and ordinary applications, including that to Geometry; Plane and Spherical Trigonometry, and the construction of trigonometrical tables; Mensuration of Planes and Solids; the Elements of Euclid, six books; the Geometry of Planes and Solids and Descriptive Geometry; also Co-ordinate Geometry of two dimensions, and Conic Sections; they should also possess a competent knowledge of the theory and application to practice of the laws of Statics including the Mechanical Powers, Dynamics, Hydrostatics, and Hydrodynamics.

In general the mathematical acquirements are superficial;

Question 14. Do you consider that Officers are sufficiently instructed when they join at Chatham, either as regards the extent or the depth and accuracy of their knowledge, to enable them to follow the course with full advantage?

From the observations above made, it will be seen that means and opportunities do not ordinarily exist at Chatham, on which to form a correct judgment as to the extent and depth of the mathematical acquirements of the Officers while under instruction there; but, it may be said, that while in each batch one or two are generally found who possess a comprehensive knowledge of the subject, who are not found wanting when—as sometimes happens—questions of difficulty arise and are submitted to them, and who even occasionally extend and improve that knowledge whilst at Chatham, yet as regards the greater number, though their knowledge may be considerable in extent, it is nevertheless but superficial, and as a matter of course is soon forgotten, even whilst still at Chatham. These latter Officers cannot, however, in many instances be said to have been insufficiently instructed, but from the want of natural aptitude for the subject, they have never fully comprehended and appreciated it, and from the removal of the necessity for its study their knowledge rapidly declines; and it appears to me, considering how few minds are found of that peculiar mathematical bent without which the study is a labour, a different result could scarcely be anticipated.

which is attributable to the inaptitude of the majority of minds.

Under the present system, no addition can be made to the Chatham course.

Question 15. Are there any subjects, not at present taught at Chatham, which you think should be added to the course? or can you suggest any improvement in the general mode of instruction pursued?

In regard to the course of instruction now pursued, I do not think that any extension of it, or the introduction of any additional subjects, could be made with any prospect of advantage under the existing system. The course now consists of the study of the attack and defence of fortified places, of the art of sapping and mining, and the application

of gunpowder to the demolition of works and buildings, and blasting above and under water; field fortification; the construction of military bridges, and the demolition of permanent bridges, and their temporary repair; trigonometrical surveying and levelling, military sketching and reconnoitering, the drawing of topographical plans and practical astronomy; also practical architecture, including measuring and estimating, and the selection of materials. Chemistry has also been recently introduced, but is not obligatory.

The subjects already studied do not receive sufficient time and attention.

Even to these subjects, I believe it must be admitted, that the time and attention which are requisite for a complete mastery of them are not bestowed by the young Officers. The release from the close application to the studies of Woolwich Academy, the attainment of the immediate object of those studies —a commission, the absence of all incitement to further emulation and of prospect of advantage to be gained readily accounts for the reluctance to study and exertion which is so generally manifested, and the consequence of which is to the responsible Officers of the Establishment so much heavy labour and anxiety.

Desirability of an examination at the end of fifteen or eighteen months for permanent commissions.

The course which I would propose to remedy these defects, so far as they result from the system, and, as far as possible, to ensure that on leaving Chatham, the Officers should be competent to enter upon their duties as Engineers, would be to specify a time—say fifteen or eighteen months—within which they should be required to acquire the necessary professional knowledge, and at the end of that time, that they should undergo a searching examination by a Board of Officers altogether unconnected with the establishment, when, if found qualified, they should be gazetted to the full rank and pay of Lieutenant, their previous rank being only temporary or probationary, with pay as at present. Their studies I would propose to leave, in a great degree, to the Officers themselves, but would provide ample means for their guidance and assistance through the appointment of competent Officers as Superintendents, and by instituting series of lectures on the several branches of study and inquiry.

I do not think it would be desirable to make subject to alteration the relative positions of the Officers as determined on leaving Woolwich, provided the necessary acquirements were attained within the prescribed time; but in the event of an Officer failing in this, unless through sickness, which would be specially considered, he would be passed over.

The subjects now studied might be more fully developed.

Under such an alteration in the system as above proposed, I believe considerable advantage might be expected to accrue, and the general efficiency of the Officers be greatly augmented. I would not under it recommend any addition to the subjects of study; but those which are at present pursued, might, I think, be much more fully developed. For instance, with the study of the attack and defence might be combined the consideration of the value of fortifications and their strategical distribution, and selection of sites for the defence of different nations. Tactics and strategy should also be studied with special reference to the operations of the Engineer. To the architectural course might also be added the construction of vaults and arches of large span, of revetments, of foundations, under the many circumstances which occur, of roofs and floors of great width, requiring skilful combinations, and the value, selection, and preparation of the different materials used in construction.

It is necessary that I should state, however, that any attempt to introduce such a system as I have pointed out would, I am convinced, prove a total failure, unless advantages far beyond those which the Engineer service at present presents were held out to the young Officers. Few, I believe, would be found under present circumstances willingly to extend the period of their probation, and, in a measure, compulsory studies, when commissions could be at once obtained in other branches of the service free from all uncertainty and comparative present restraint, as well as future labour.

Question 16. In case of such improvements being effected, what additional amount of previous mathematical knowledge would become requisite?

To meet such an alteration in the system as above indicated, no additional amount of mathematical knowledge would in my opinion be necessary.

Lieut.-Colonel M'Kerlie, R E.

Education desirable for an Engineer Officer.

Question 17. Without reference to what may be the present state of teaching, what do you consider to be the education, both scientific and practical, which would most completely qualify an Officer of the Engineers for the discharge of his various duties?

In regard to the question as to the education, both scientific and practical, which would most completely qualify an Officer of Engineers for the discharge of his various duties, the answer would scarcely admit of any limitation. I am of opinion, however, that to enable an Officer to enter upon his ordinary duties, the amount of mathematical knowledge stated in the reply to the first question should be considered as a minimum. He should be thoroughly acquainted with the several subjects referred to, as taught or proposed to be taught at Chatham, and of the science of war, embracing strategy and tactics. He should possess a practical knowledge of the use, power, and effects of artillery. He should read with facility the French and German languages, and speak fluently at least one of these. He should have a sufficient knowledge of practical chemistry to enable him to analyse and form an opinion on the value of limes, cements, and the materials used in construction. A practical knowledge of geology is also a valuable and necessary acquirement; and lastly, it is essential that he should have a ready command of the pencil, and skill and taste in drawing.

The studies of an Officer of Engineers may be said, however, to have little more than begun on his first entering the corps. His further scientific acquirements will of course be guided and determined by his own views, while his practical knowledge must in a great measure be dependent on the circumstances under which he may be employed.

I have, &c.
(Signed) J. S. M'Kerlie, Capt. R.E.

Captain Bainbrigge, R.E.

From Captain Bainbrigge, R.E., Professor of Fortification at the Royal Military Academy.

Woolwich, April 22, 1856.

Sir,

In reply to your letter of the 11th March last, requesting me to suggest any measures which may seem to me calculated to render the existing education of Cadets for the Royal Artillery and Royal Engineers more efficient, and to state what facilities Officers have for attaining the scientific knowledge required, I beg to observe that it appears to be desirable, in the first place, to obtain information relative to the particular points in which the knowledge of Officers has proved deficient, more especially with regard to those who have been engaged before the enemy, as fitness for carrying on operations in the field is evidently of the greatest importance.

Those who have seen service in the Crimea have informed me that some of the Artillery were deficient in knowledge of the modes of moving guns and preparing ammunition, and that some of the Engineers were not able to sketch ground sufficiently rapidly, but that they all had sufficient mathematical knowledge. I therefore recommend that greater attention to the former subjects should be insisted upon. The Officers who have charge of the instruction in these branches are best able to state what additional assistance they require to render it more complete; it must, however, be manifest that a great deal of practice in sketching and studying the forms of ground, as well as the effects and ranges of different arms and missiles, is indispensable to teach Officers the important arts of placing Artillery and Field Works in such positions as to be most capable of producing the desired effect, and that a thorough appreciation of the manner in which irregularities of ground affect the question is of the greatest importance. The French appear to be of this opinion, and I believe that the young Officers preparing for their corps of Engineers at Metz devote a great deal of time to the study and delineation of ground. I feel sure that it cannot be properly taught unless very small classes are placed under the

Importance of the practice of rapid sketching.

CAPTAIN BAINBRIGGE, R.E.

constant guidance of Officers who have really practised the rapid sketching which is indispensable before an enemy in the field.

There is another evil existing in our Army, which is a want of conscientiousness in the discharge of duty, especially during peace time, accompanied by apathy in acquiring the necessary knowledge, which proves the importance of paying the greatest attention to moral and religious culture, supporting the chaplains in their efforts, and increasing their influence and efficiency.

Officers to be quartered at Chatham on return from foreign service.

As regards the "facilities afforded for learning their duty," Officers of Engineers have the advantage of professional libraries, established and supported by their own subscriptions, at all the principal stations, but it would be very advantageous if all Officers of the corps were quartered at Chatham on returning from foreign service, that they might again study the construction of field-works, &c.; and there would be little difficulty in extending the drill in moving heavy guns, &c. at all fortresses, so that all Officers of Artillery might keep up their knowledge of it.

With regard to the instruction in mathematics, the number of Professors and Masters must, of course, depend upon the time to be devoted to it; but it may be remarked that, as a solid knowledge of this subject ought to be considered indispensable, it is very desirable that all who are selected to impart it should have the power of arousing an interest in it, by rendering the study of it as practical as possible, and making the students see its utility.

Necessity of a large proportional number of instructors in fortification.

Fortification, or rather the attack and defence of positions of every description, has for many years been taught at the Royal Military Academy as a practical subject, instead of (in the manner formerly usual) as a theory, which was to be learnt by merely drawing plans; and the failures in imparting any real knowledge of it by civilians show the necessity for providing instructors acquainted with military operations and the capabilities of Artillery and Infantry for attack and defence, so that the students may be made to realize the idea that they are preparing to execute works under the fire of an enemy, and must reason on the means likely to be available under different circumstances for carrying them on. This can only be thoroughly taught by dividing them into sections of not more than ten each, so that each student can clearly see all the details of the numerous plans and models which are necessary to illustrate and explain the subjects lectured upon, and to admit of their being questioned and made to reason on them. They must also be taught to draw plans of the works, to impress upon their minds the forms, dimensions, and relative positions of each, and also because it is indispensable (especially for Engineer Officers), to possess facility in this kind of drawing. From this it will be evident that such constant personal explanation is required in this branch, that if the age of admission is raised, and more time in each term devoted to it, more instructors will be required in proportion.

In order to facilitate the progress of students in acquiring a knowledge of the French and German languages, I beg to suggest that the number under each Master should be more limited, and that conversation, or repeating sentences aloud, should be insisted upon.

Landscape drawing; value of colouring.

Plan-drawing. Modelling.

It appears to me that there ought to be at the head of the instruction in landscape drawing a first-rate artist of acknowledged reputation, especially for the purpose of arousing a greater taste for colouring, which is an art of much value, especially to Officers of Engineers; and that the study of plan-drawing should be combined with that of large contoured models of ranges of hills on a larger scale than those in use (so as to teach the appreciation of the forms of ground), for which purpose, wet sand might be used with advantage.

I have, &c.

(Signed) P. J. BAINBRIGGE, Captain Royal Engineers, and Professor of Fortification.

To the Secretary to the Commission for Reporting on the Education of the Scientific Corps.

Captain Cameron, R.E.

From Captain Cameron, R.E.

Ordnance Map Office, Southampton,
April 25, 1856.

Gentlemen,

I have the honour to reply to the questions sent to me with your letter of the 11th March.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective corps?

As a general rule, I believe no instruction is given to the Officers of Royal Engineers after leaving Chatham, excepting such as they may derive from the Officers and professional men with whom they are employed together in carrying on the same works.

Desirability of further instruction after joining.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

I think it would be most desirable that further instruction should be given to Officers after joining. There are few Officers of Engineers, I believe, who have not felt themselves at a loss, at some time or other, for want of practical knowledge, which they could not acquire from books. As to the best means of imparting this knowledge I am hardly able to give an opinion. After completing the course at Chatham, the Officers might be sent to visit the great works of different kinds which are always in progress in this country, and, on their return, might be examined as to their practical acquaintance with the modes in which the works are carried on, and be called on to produce drawings, &c. It is presumed also that Officers will in future return to Chatham after each term of foreign service, and will then be able to refresh their memories, and to acquire further instruction both in the civil and military duties of their profession

Senior Department not necessary.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

I do not consider any instruction similar to the Senior Department at Sandhurst to be necessary.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

I do not know of any addition which it would be desirable to make to the duties of Officers of the Royal Engineers. I presume that Officers will be attached to the Divisions of the Army which are now being formed at Aldershot, Shorncliffe, &c., where they will have better opportunities of learning and studying military duties than the Corps has enjoyed hitherto.

Inexpediency of a union of the two Corps.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

It appears to me that it would be anything but desirable to assign any of the duties at present performed by Officers of the Royal Artillery to the Engineers, or *vice versâ*. As regards a union of the two corps, I think it would be very inexpedient, the duties of the Engineers being already very multifarious.

Instruction to commence with the Practical Class.

Question 9. Do you think it would be more advantageous to the public service that the Officers of the Artillery and of the Engineers should (after being selected, as now determined on, by means of a public

I should prefer sending the junior Officers to join a Practical Class, and giving them practical instruction. Officers can pursue the study of abstract science and of modern languages, without assistance from the Government, except, perhaps,

competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

for the latter purpose, by having leave given them to travel abroad.

CAPTAIN CAMERON, R.E.

I have, &c.
(Signed) J. CAMERON,
Captain Royal Engineers

From CAPTAIN GALTON, R.E.

CAPTAIN GALTON, R.E.

Board of Trade, Whitehall,
London, April 24, 1856.

SIR,

IN accordance with the request of the Commissioners for Reporting on the Education of the Scientific Corps, conveyed to me in your communication of the 11th ultimo, I have the honour to transmit to you the enclosed replies to the questions which accompanied your letter.

I have, &c.
DOUGLAS GALTON,
Captain Royal Engineers.

A. H. Clough, Esq., Secretary
to the Commissioners for Reporting
on the Education of the Scientific Corps.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective corps?

Nature of the Chatham course

After leaving the Woolwich Academy, the Engineer Officers proceed to Chatham, where their knowledge of fortification is developed by being required to lay down projects for the attack of fortified places; they learn the practical details of field works, and works of attack, mining, and the construction of pontoon bridges; they also receive instruction in Surveying, Practical Astronomy, and Military Reconnoissance.

Besides this, they pass through a theoretical course of Civil Architecture, showing the method of planning, specifying, estimating, and measuring buildings; but they are not required to apply this information.

it does not comprise the higher branches of Military Science.

After an Officer has left Chatham, he receives no further professional instruction; he must obtain practical knowledge as he finds the opportunity—and he is not yet acquainted with the higher branches of military science.

The theoretical education which an Officer has thus received is very much better than that received by the large majority of Civil Engineers, and if he were at once placed in situations where he would be required to apply his knowledge practically, and where he would be responsible for the works he superintended and for the duties he performed—as is the case with Civil Engineers—he would gain that practical knowledge which his education does not afford him.

Reasons why the application of theoretical knowledge should form part of the education given.

But an Officer is not unfrequently sent to some out-station or colony, where persons under him are employed to superintend and to be answerable for details of construction, and where Officers over him design new works. He has often no responsibility, and therefore takes no interest in his duties.

It is only in some rare instances that a young Officer is placed in circumstances where, being required to think for himself, he obtains practical knowledge.

On the other hand, Officers, when they have advanced in their profession, are generally placed in responsible positions, and are required to design and execute works calling for an amount of practical knowledge which their previous training has not necessarily given them an opportunity of acquiring. They are required in every variety of climate to deal with all sorts of different materials, they are frequently placed in isolated situations and unable to consult books, or to learn from the experience of others.

The duties of the corps, therefore, require that every Officer should possess much knowledge which he is not necessarily afforded the means of acquiring, either whilst under instruction or after he has joined the corps.

CAPTAIN GALTON, R.E.

Much might, no doubt, be done to remedy this by a modification of the duties of Engineer Officers; but it would be very difficult to arrange the duties so as to educate all the Officers, and the duties might suffer from such an arrangement.

Under these circumstances, therefore, it appears desirable that the education of an Engineer Officer should include the application of theoretical knowledge and instruction to the practical details of the principal parts of his profession.

I would also add, that a knowledge of modern languages is almost a nominal consideration at present, although such knowledge is of very great importance.

Question 5.—Would it be possible, and, if possible, desirable, to have further instruction or assistance gvien to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

I am of opinion that it is possible, and very desirable, to give further instruction to Engineer Officers.

Military and civil Duties of an Engineer Officer.

The profession of an Engineer Officer requires knowledge, first, of military duties; and, secondly, of civil duties.

A thoroughly practical acquaintance with the first can only be acquired in time of war. A practical knowledge of the second can be given at all times.

Knowledge requisite for both. Education preliminary to the State course.

In both, the knowledge of a certain amount of Mathematics, Modern Languages, Drawing, History, and Geography may be considered essential; these might be taught to a great extent before the State education begins.

Mathematics applied to mechanics, machinery, &c.

For the efficient performance of both duties, it is essential that the Officers should be conversant with the application of Mathematics to every variety of mechanical question; and that they should possess a thorough knowledge of machinery, and of the strength and other qualities of all materials used in engineering works, and the modes in which these materials are worked and applied.

Physical science.

They should be conversant with Chemistry, Metallurgy, Geology, and Mineralogy.

How to be made available.

This knowledge should be made available by teaching them to design, in a detailed manner, civil and military works, according to specified conditions; and it should be still further tested by the construction of large models.

Surveying already efficiently taught.

A knowledge of Geology, Surveying, and also of Practical Astronomy, is required in Civil and Military Engineering; Surveying is, I believe, efficiently taught by the present system.

Necessary subjects which are at present taught imperfectly, or not at all.

Fortification, the art of Attack, Mining, Artillery, and instruction in the duties of an Engineer Officer in the field, should be taught in a more comprehensive manner than is at present the case; and Castrametation, the duties of the Quartermaster-General's department, Military Science, Tactics, and Strategy, in which no instruction whatever is given, should be added to the course.

The application of temporary expedients, which would be often available in the field, might be taught in a systematic manner.

This course of study, combined in a judicious manner with that which is at present given, would probably afford the students as much knowledge of their duties as could be learned without the practical experience afforded by war.

In time of peace, practical experience could only be given in the civil part of the profession, but practical knowledge gained in the construction of civil works would qualify men better than any other education for the varied duties of the Engineer Department in the field.

Practical training at stations with provisional commissions.

With this object, the students should be attached to stations at which works are in progress, either without commissions, or probably with provisional commissions, in the capacity of Assistant Engineers, where they should be employed in making working drawings, specifications, and estimates, and in the minute and constant superintendence of works, for the detailed execution of which they should be held as strictly responsible as the articled pupil of a Civil Engineer.

Senior Department as an Institution for theoretical instruction not necessary.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

The object of the Senior Department at Sandhurst is to enable Officers to obtain theoretical knowledge applicable to their profession.

An Officer should not be admitted into the Engineers until his theoretical education is sufficient to qualify him for solving generally professional questions; therefore, strictly speaking, a Senior Department similar to that at Sandhurst is not necessary.

Desirability of a short course at Chatham on return

But in order to give every Officer knowledge of the latest improvements in his profession, and to make him conversant with all his military duties, it would be desirable that periodically, as, for instance, on every occasion of returning

from foreign service, Officers should attend a course of instruction there. proceed for a short time to Chatham, and

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

from foreign service.

In time of peace, the Engineer Officer's knowledge of military duties should be kept up by periodical exercise, as suggested in the reply to question 6.

Duties in time of peace.

But all duties which place them in situations of responsibility, and where judgment is required, would tend more than anything to draw out their capabilities, and improve their efficiency for purposes of war.

Construction of civil works, &c.

Therefore it is very desirable that they should be employed in the construction of civil works, and in duties connected with teaching large bodies of soldiers to execute works in the field, &c.

It is also desirable that Officers should be encouraged to examine in detail any large civil engineering works that may be in progress.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

The education to be given must be dependent upon the duties which the Officers will be required to perform. These duties must be assigned solely with reference to the public good; it is therefore difficult to see how they can be considered as a question of education independent of that object.

However important this question may be, it cannot, I think, be discussed only with reference to the two corps, as it involves a consideration of the apportionment of duties of other departments of the army; and it is also one into which it is not the province of these remarks to enter, as it belongs exclusively to those in whom the management of the army is vested.

I would, however, observe that it might, on the one hand, be advantageous in an educational point of view to the Artillery, to be required to perform some of the duties at present performed by the Engineers; and, on the other hand, it would afford the Engineers important practical professional knowledge to be employed to superintend the manufacture of ordnance and the machinery connected therewith; but, from the same point of view, it is probable that the omission of either of these duties might act injuriously upon the corps from which they were abstracted.

These considerations lead to the second part of the question, viz. the possible union of the two corps.

Education of the two corps; how far identical.

So far as concerns their education there can, I think, be no doubt that Officers of Artillery should be as thoroughly acquainted with the principles of fortification as Engineer Officers with the effects of artillery. The education of both corps should, I think, be identical as regards military science, fortification, and field works, and the principles of gunnery, of the equipment of artillery, and of the laboratory course.

Hence the education of both includes a considerable knowledge of mathematics and physical science, of the nature and application of materials and of machinery.

Modern languages are essential to both services.

Surveying would also be necessary, at least as far as regards military reconnoissance.

Point of divergence.

But at this point a divergence of education would take place, the Engineer proceeding to study the practical details of the construction of works, and other special branches of his duties; the Artillery Officer, on the other hand, proceeding to make himself acquainted with the details of his part of the profession.

Whether Officers could be made thoroughly efficient in both capacities is questionable.

The detailed knowledge of their respective duties which the Officers of each corps must thus acquire, is very considerable, and it appears to me to be, to say the least, very questionable whether it would be possible for the Officers to be made thoroughly efficient in both capacities.

CAPTAIN GALTON, R.E.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

One examination of candidates for both Corps.

I am disposed to think, that it would be most advantageous to the public service if the requisite state of education in the country would admit of it, that the candidates should be required to possess such an amount of mathematical and general knowledge when they are selected, as would enable them immediately to devote their time to the acquirement of special professional knowledge.

It might possibly be deemed advisable that this amount of knowledge should depend upon the corps in which they were intended to serve; but I am inclined to think that a better selection for both corps would be obtained by continuing the present system of joint examination.

The considerations which would fix the limits of the age under which candidates should be selected appear to be generally as follows, viz. :—

Age of candidates.

That youth is an important element in the military training of both mind and body.

That it is desirable to attract that large class of persons to whom the early selection of a profession for their sons is a desideratum, and also those who, with chances of future success in life, would yet be content to forego them for a less brilliant but more sure career, one in which they would be saved the expenses and risks of a college life, and in which failure would not injure their prospects for other professions.

These considerations point to nineteen as the upper limit of age; the lower limit must depend upon the age at which the qualifications can be obtained, and it might consequently be unnecessary to name any. If a limit be, however, thought desirable, probably it should be seventeen.

These remarks are founded upon the assumption that the necessary amount of mathematical and other knowledge can be obtained. If this should be found not to be the case, it would be necessary for a lower scale of knowledge to be required, and for further instruction to be given after the candidates have been selected. The scale of acquirements must then depend upon what can reasonably be expected to be obtained, and the upper limit of age must also be made lower. But I am not competent to express an opinion as to what this reduced scale of knowledge or limit of age should be, without more information, as to what can be expected, than I at present possess. I would, however, observe that whatever be the state of the case now, it is to be hoped that at some future time the higher scale of knowledge may be obtained.

Minimum amount of knowledge which a candidate should possess.

The following is the minimum amount of mathematical and general knowledge which, on the assumption that it can be obtained, a candidate for the Engineers should possess before selection for the special professional education :—

A sound knowledge of Mathematics, including the Differential and Integral Calculus, to such an extent as would enable them to apply Mathematics with facility to questions connected with geodesy, construction, and machinery in their widest acceptation.

They should possess a sound knowledge of the first principles of Physical Science in its different branches.

They should be well acquainted with Geography, especially Physical Geography.

They should be well acquainted with Ancient and Modern History

A knowledge of Latin and Greek is desirable.

They should be able to read with ease, and to translate correctly from English into either French or German, if not into both languages.

Landscape Drawing is also desirable.

Military College for both corps.

After having been selected by examination, the candidates for the Artillery and Engineers should be educated together at a Military College. As they would be nearly of the same age as men at the University, it would be desirable that they should be allowed a reasonable degree of liberty.

If, however, it were found necessary to take younger candidates, possessing a less amount of knowledge than is shown above, and to give the additional instruction required in these subjects, after selection, it would be necessary to

CAPTAIN GALTON, R..

combine this additional instruction in a judicious manner with the special professional education.

It does not, however, appear to be desirable to do more here than to sketch out what the proposed education should include, upon the assumption that the amount of mathematical and general knowledge above mentioned can be obtained.

Subjects to be studied at the Military College.

In the Military College the candidates should be required to apply their mathematical knowledge to questions of mechanical and physical science. They should be taught the theory of the art of War and Fortification, including every branch of Attack and Defence; Plan Drawing, Descriptive Geometry, the Elements of Architecture, the Principles of Chemistry, Geology, and Mineralogy, and experimental knowledge of the different qualities of materials, and the modes of their application.

They should learn Geodesy, and Surveying in all its branches, Military Reconnoissance, and Practical Astronomy. They should pass through a course of Artillery somewhat similar to that now taught in the Practical Class.

The course there to last two years,

It is not probable that the period required for this instruction could be less than two years. During this time they should be taught the drill of the Infantry, Cavalry, and Artillery soldiers, Fencing, and other Exercises.

and to be followed by an examination.

Upon leaving the College, they should be subjected to an examination in order to determine the position they are to occupy in the corps for which they are destined.

Engineers to proceed to Chatham with provisional commissions, their studies there.

The Engineer Officers should then proceed to Chatham, to learn to design, trace out, and execute every variety of work connected with the duties of Engineer Officers in the field. They should be taught the practical application of materials, in accordance with theoretical laws, to Structures and to Machinery, and also the art of planning, specifying, and estimating, as well as the details of construction of Military and Civil Works.

How they should be employed on joining their corps.

They should be exercised in duties in connexion with large bodies of men.

After leaving Chatham, the Engineer Officers should proceed to assist in any works in progress, where they should be employed in framing detailed estimates, working drawings, and in superintending the detailed execution of particular portions of works.

I think that commissions should be given provisionally on leaving the Military College, and not confirmed until the Officers are ready to join the corps for duty.

The whole course to occupy three or four years.

The whole education would not occupy less than three or four years.

It may be urged that the age at which an Officer would join his corps after this education would be greater than that at which it is considered desirable that Line Officers should enter the Army. But it must be recollected that they would be, to all intents and purposes, in the army, and learning their profession, from the time of passing the first examination.

I have purposely abstained from entering upon the question of any modification of the duties of Engineers, and I have confined my remarks to the education of the Artillery and Engineers. Much of the education that is required for these corps might be advantageously given to the rest of the Army.

(Signed) DOUGLAS GALTON,
Captain Royal Engineers.

April 24, 1856.

CAPTAIN SCOTT, R.E.

From CAPTAIN SCOTT, R.E., Superintendent of Surveying, Practical Astronomy, Chemistry, and Civil Works, and of the Halls of Study, at Chatham.

GENTLEMEN, Brompton Barracks, Chatham, April 24, 1856.

I HAVE the honour to enclose my replies to the questions you have circulated concerning the training of Officers for the Scientific Corps.

I have also forwarded, by rail, a catalogue of the works in the Royal Engineer Establishment Professional Library. These works are purchased with funds supplied by the Officers of Engineers stationed at Chatham.

I have, &c.

(Signed) HENRY SCOTT, Captain Royal Engineers.

The Commission for Reporting on the
Education of the Scientific Corps,
War Department, Pall Mall.

CAPTAIN SCOTT, R.E.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective corps?

The course of study pursued at the Royal Engineer Establishment at Chatham is fully detailed in the synopsis with which the Commission has been supplied, and I consider it necessary only, in reply to this question, to make the following remarks upon the mode in which some of the exercises are carried out.

Method of instruction in use at Chatham.

It is supposed that Officers, on joining at Chatham, possess sufficient theoretical knowledge to undertake the projects of attack, demolition, and military bridges, without further assistance than can be gained from the code of instructions alluded to, and the field operations they witness and make memoranda on; the former points out to them the manner in which the exercises are to be drawn up, and from the latter they acquire the practical details necessary. The project, during its progress, is weekly examined by the Instructor in Field-works, to see that proper diligence and care is being bestowed upon it, and from this Officer, or one of the other Captains attached to the establishment, may be obtained an explanation of any difficulty that may occur.

1. Projects of attack.

When completed, the Director either reads it himself with the Officer who sends it in, and remarks upon its defects, or appoints one of the Captains to do so.

2. Surveying and field sketching.

In surveying and field sketching they have likewise been sufficiently instructed to undertake the exercises given them, after receiving a few preliminary hints and directions, and some actual assistance in the field on commencing each new operation. The work performed each day is on the following morning produced to the Superintendent, that he may check carelessness, point out defects, and give further help in the field when required.

3. Practical Astronomy.

The use of the astronomical instruments in the Observatory is necessarily carried on in the presence of the Superintendent, to preserve them from the injury which might be done to them by carelessness, or from inexperience.

4. Architecture.

The Architectural Course, a branch of instruction in which no previous knowledge has been acquired, is carried on to a great extent by lectures delivered in a manner to enable the Officers to write them out word for word, and to question the Instructor on points they do not understand.

In every branch of the course, Officers are referred to professional works bearing on the exercise on which they are employed; and these works are purchased with funds provided by themselves.

The introduction of abstract mathematics into the course would be unadvisable.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

I do not think it would be advisable to alter the present mode of instruction. It would be useless, for instance, to attempt to increase the scientific attainments of Officers by the introduction at this establishment of abstract mathematics. The necessary degree of attention would never be given by young men surrounded for the first time by the attractions of a military life, and with the spur of competition recently removed. To be efficacious, the instruction of an Officer must be of a nature to admit of its results being readily examined, and idleness or carelessness checked at once, without the necessity of a formal examination to ascertain the degree of his mental progress. This the present system is calculated to secure, whilst it tends at the same time to draw out an Officer's resources and to give him self-reliance, points of the highest importance in the education of a soldier.

The additional instruction which, in my opinion, should be given to Officers of Engineers after joining, and the best means of affording it, are explained in my reply to Question 15.

A Senior Department not desirable.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

No.

An extension of theoretical acquirements not necessary at least for junior officers.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the

I am not aware of any, and I consider that, in the junior ranks at least, Engineer Officers do not so much need to extend their scientific acquirements of a theoretical nature, to enable them to per-

the scientific studies requisite for the efficient performance of their duties in time of war?

form their duties efficiently in time of war, as to acquire a more intimate knowledge of the details of their profession, and the habit of applying, mentally at least, to actual cases, principles which in themselves are readily understood, and only become difficult in their application.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

I think that the public service would be injured by such a measure. The details of one of the professions are, I believe, more numerous than men of fair capacity now make themselves masters of. The corps should be separated as soon as a general knowledge of the scientific duties of each profession has been acquired.

The union of the two professions would be injurious to the service.

Question 9. Do you think it would be more advantageous to the public service that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties; or would you suggest any other plan?

I consider that it would be more advantageous that candidates for the Artillery and Engineers should be sent for one or two years to a Military College, for instruction in the scientific studies, the modern languages, and military discipline, before entering upon their practical studies as Officers. I think that the special education of an Officer of Engineers should commence about the age of seventeen, and that he should then be placed under strict military discipline. Engineer Officers, as a general rule, see little military service after leaving Chatham, and therefore their education as soldiers should commence when there is the opportunity, that their military character may not be lost sight of,—a point, in my opinion, of the highest importance. In order to carry out this special education, I consider that at the above-mentioned age he should enter a Military College, possessed of a competent knowledge of most, at least, of the subjects included in my reply to Question 13, of English Composition, General History, Foreign Languages, and the other branches of an English gentleman's education. That in this college he should first devote himself to Military Exercises; to acquiring a facility in applying Elementary Mathematics and Physics to practical questions; to the theory of Fortification; to Mechanical, Plan, and Landscape Drawing, and Languages; and then, if he become proficient in these studies, to the acquirement of the higher Mathematics. During the latter twelve months of the period spent in the college—the whole period should be two years and a half—he should be instructed in Practical Artillery, Practical Field Fortification and the operations of a Siege, and the Passage of Rivers; and, since much of his education will now be mechanical, and prove no great tax on his mental powers, he might also receive, by lectures or otherwise, some general instruction in Experimental and Applied Sciences.

Candidates for the Artillery and Engineers to be sent for one or two years to a Military College.

Special education to commence at seventeen, under strict military discipline.

Subjects of the professional course which should last two years and a half.

Subjects for the last year of the course.

The course, in my opinion, advisable to follow at Chatham, is explained in my replies to the former questions; and, after leaving that establishment, a young Officer's future education must, in the main, depend upon his own tastes and exertions, but every reasonable opportunity and assistance should be given to an Officer whose previous conduct justifies the step, to enable him to examine works pursue branches of science bearing on his professional duties, and to acquire and foreign languages. It would be advisable, also, at the expiration of his first term of foreign service, which may be taken at six years from entering it, that he should return to Chatham for a short period to refresh his memory in the practical details of the military branches of his profession.

Return to Chatham after the first term of foreign service.

Question 13. What, in your opinion, is the amount of mathematical knowledge, which according to

Arithmetic, Algebra, Geometry, Mensuration, Plane and Spherical Trigonometry, Conic Sections, and such a

CAPTAIN SCOTT, R.E.

the usual system (as pursued prior to the war) is requisite for passing, with advantage, through the course of study followed at Chatham?

knowledge of Statics, Dynamics, Hydrostatics, Hydrodynamics, Pneumatics, and the strength of materials, as can be attained without the assistance of the higher Mathematics. Sufficient acquaintance with the elements of Optics to understand the construction of the Telescope and Microscope, and a perfect knowledge of Astronomical Definitions, and the Problems for determining Time, Latitude, Longitude, and the Direction of the Meridian.

The knowledge possessed on joining at Chatham deficient on some subjects, and unnecessarily extensive on others.

Question 14. Do you consider that Officers are sufficiently instructed when they join at Chatham, either as regards the extent or the depth and accuracy of their knowledge, to enable them to follow the course with full advantage?

The generality of Officers have not, in my opinion, on joining at Chatham, so thorough a knowledge of the subjects they have studied as to be able readily to apply their information; neither has their theoretical course extended to the study of Natural Philosophy, some acquaintance with which I consider absolutely necessary to enable them to follow the Chatham course with full advantage. On the other hand, it has embraced the higher Equations, which are comparatively of little use, and the Differential and Integral Calculus, which should be studied, I think, by those only who have already a familiar knowledge of the fundamental principles and propositions of Elementary Mathematics and Physics, and have no difficulty in applying them to practical purposes.

A six months' course on Civil Engineering desirable.

How to be carried on. 1. Lectures.

Question 15. Are there any subjects, not at present taught at Chatham, which you think should be added to the course? or can you suggest any improvement in the general mode of instruction pursued?

I think that to the present instruction in practical architecture should be added a six months' course of Civil Engineering, to be carried on—

1st. By a series of twelve lectures, well adapted to give an Officer a general view of the nature and extent of the works which, in the civil branch of his profession, he may be called upon to perform.

2. Abstracts from professional works

2nd. By drawing up abstracts from good professional works, to obtain a more accurate knowledge of the details of the subjects than could be conveyed in the form of lectures.

3. Designs of works.

3rd. By designing and detailing on supplied data, and with the assistance of good examples, of which descriptions and estimates have been published, various engineering works of a suitable character.

4. Visits to civil works.

4th. By visiting, under the guidance of a competent Officer, instructive civil engineering works.

5. Chemical Analysis.

5th. By a short course of Chemical Analysis, sufficient to enable an Officer to examine roughly, though with the requisite degree of accuracy for such a purpose, the various building materials and other bodies with which he may have to deal, and thus, as far as possible, supply the want of experience in judging of their fitness for their intended application.

6. Practical Geology.

6th. By a similar course of Practical Geology, carried on chiefly by examining under the guidance of a competent Officer, localities rich in instructive varieties of formation, and by making a Geological report on the tract of country assigned for his military reconnoissance.

With many Officers the great impediment to study in after life arises from their ignorance of the manner in which they should set to work. These courses would remove the difficulty in two very important branches of education.

7. Experimental Electricity and Magnetism.

7th. By a sufficient amount of experimental instruction in the elements of Electricity and Magnetism to enable an Officer to deal intelligently with the numerous practical engineering applications which these sciences now have.

Officers have now the means of acquiring a knowledge of Analytical Chemistry and Magnetism, but they are not compelled to avail themselves of them.

With reference to the second part of the question, I consider the general mode of instruction pursued here well adapted to the purposes intended; but I should recommend that means should be granted for enabling experimental constructions to be carried on more extensively than at present.

Question 16. In case of such improvements being effected, what additional amount of previous mathematical knowledge would become requisite?

A more accurate knowledge of Elementary Mathematics and their application than Officers usually possess, and a familiarity with the fundamental principles of Physics.

(Signed) HENRY SCOTT,
Captain Royal Engineers.

CAPTAIN SCOTT, R.E.

From MAJOR DU CANE, R.E., Superintending the Instruction in the Electric, Magneto-Electric, and other Field Telegraphs at Chatham.

MAJOR DU CANE, R.E.

Royal Engineer Establishment, Chatham,
April 12, 1856.

SIR,

I HAVE the honour to submit to the members of the Commission appointed to report on the education of the Scientific Corps, the following answers to the questions which accompanied their circular letter dated March 11, 1856, Metz.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers after joining their respective corps?

Course pursued at Chatham.

After being appointed to the Engineer Corps, every Officer so appointed is sent to the Royal Engineer Establishment at Chatham, to receive instruction in the following branches:—

1. Field-works, which embrace the construction of batteries, parallels, magazines, and saps, mining, and indeed of all works bearing on siege operations.
2. Pontooning and the construction of military bridges.
3. Surveying, which includes field sketching, special and general surveys, military reconnaissance.
4. Architecture as applicable to the construction of barracks.
5. Practical Astronomy, for which an Observatory has been established.
6. Projects of attack, journals of sieges, demolitions of buildings, &c., and fortifications.

To the foregoing, I should add Analytical Chemistry, for which a laboratory exists. Instruction in this branch is, however, of a voluntary nature.

Analytical Chemistry should be added.

Instruction is also being given in the use of the electric telegraph, as applicable to military purposes, and arrangements have been made for instruction in photography.

Every Officer has also to perform his regimental duties, and to attend parades and drills.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

I consider the first and paramount object to be secured in the education of an Officer of Engineers after joining his corps, is to afford him that course of instruction, scientific and military, which will be most conducive towards his becoming a well-educated and practical military engineer, and a good soldier, and the course established at Chatham is, I consider, calculated to effect this object if taken advantage of.

But as it has been found desirable to employ Officers of Engineers upon duties which do not strictly belong to their military profession, and which come under the head of civil appointments, and as an Engineer Officer possessed of a certain knowledge of such duties has a greater advantage over, and will be found, especially in some of our Colonies, more useful to the public service than an Officer who does not possess such knowledge, I am strongly of opinion that instruction, assistance, and encouragement should be given to Officers of Engineers in the prosecution of such extra duties.

The employment of Engineer Officers on civil duties calls for extra instruction;

Among the first of these I would name Civil Engineering, by which term I mean particularly the construction of railways, machinery, bridges, canals, dockyards, public buildings, &c.

especially in civil Engineering.

Instruction in these subjects might be given at Chatham to the young Officers on joining, and might be made to form a part of their course, following after the military portion. I am also of opinion that every means should be afforded to Engineer Officers to travel throughout the United Kingdom and on the Conti-

MAJOR DU CANE, R.E.

nent, so as to make themselves acquainted with the construction, and principles of construction, of large and important public works, civil and military.

Travelling to be encouraged;

This facility is afforded by the Honourable East India Company to their Officers of Engineers, by the United States and continental nations to their Officers.

as also the further study of modern languages.

I also think that encouragement should be given to Engineer Officers in the acquirement of our principal modern languages. It can hardly be expected that the very elementary course of instruction in modern languages (French and German are those taught) which is given at the Royal Military Academy at Woolwich, can produce any great degree of proficiency.

But travelling to inspect and report upon military and civil works on the continent would almost necessitate some study of the language of the country travelled over, and would probably lead to a more intimate acqaintance with the military, historical, and scientific continental works, than the generality of Engineer Officers at present possess.

It would also conduce to greater intercourse between our own Officers and those of other countries belonging to the same profession.

Analytical Chemistry and Geology to form part of the course.

I mentioned in my answer to Question 4, that voluntary instruction in Analytical Chemistry is given at Chatham to young Officers on joining the Engineers; I am of opinion that this branch should be made to form a portion of their course, instead of its being left, as at present, to their own discretion; and to Chemistry, I would add some instruction in Geology.

Too much stress cannot be laid upon the necessity of acquiring a full knowledge of surveying, readiness and skill in field sketching and reconnoissance, and also in landscape drawing.

Senior Department not desirable.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

In consequence of the existence of the Royal Engineer Establishment at Chatham for educational purposes, I do not consider any institution for Officers of Engineers, similar to the Senior Department at Sandhurst, desirable; but I do consider that if Engineer Officers were enabled from time to time to avail themselves of the advantages to be derived from the Royal Engineer Establishment, much benefit would arise to them and to the public service.

Officers to avail themselves of the Chatham Establishment on their return from foreign service.

Officers returning from foreign service, where, perhaps, they have been confined to one order of duty, would then be enabled to renew their acquaintance with professional subjects of equal or greater importance, whilst a short residence at Chatham would give an Officer an opportunity of affording to others the results of his own experience in whatever duty he may have been employed upon.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

I consider I have answered this question in my answer to Question No. 5.

The question of the union of the corps cannot be entertained.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

I do not consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers; nor do I consider that such a question as the union of the Artillery and Engineers can be entertained as a question of education.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Ar-

I think that it would be more advantageous to the public service if Officers of Engineers were sent (after being

tillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

selected by means of a public competitive examination), for, say, one year, to a Military College or Practical Class, previous to joining at Chatham, not merely to acquire instruction in the scientific studies, but habits of military discipline and obedience.

MAJOR DU CANE, R.E.

Course of one year at a Military College or Practical Class before joining at Chatham.

(Signed) F. DU CANE,
Captain Royal Engineers.

From LIEUTENANT COWELL, R.E.

LIEUTENANT COWELL, R.E.

London, April 22, 1856.

WITH reference to the questions submitted by the Commissioners appointed by the Secretary of State for War to consider the best mode of reorganizing the system of training Officers for the Scientific Corps, I beg to submit the following answers with much respect:—

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective corps?

Officers of Royal Engineers, on joining the establishment at Chatham, are instructed in surveying, field works, and operations connected with a siege, escalading, pontooning, construction of bridges, blasting, well-boring, &c. Besides this they are instructed in various methods of demolishing works of a civil and military character, and draw up plans and estimates, &c. for the same. They also project plans of attack against various fortresses, with all the details connected with a siege. They have the benefit of an observatory for astronomical observations, and a small chemical laboratory, and are instructed in the use of the electric telegraph for ordinary purposes. In addition to the above, they attend to the regular regimental duties connected with the Royal Sappers and Miners. Lieutenant Cowell begs to remark that the above is simply what he is aware of Officers being instructed in.

Instruction afforded at Chatham.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

In answering this question, it is conceived that the first great object is to instruct the young Officers in their military duties as Officers of Royal Engineers, all other subjects for the time being being considered as of secondary importance.

In suggesting further means of affording instruction, it would appear desirable that Officers should have greater facilities afforded them of acquiring a useful knowledge of such subjects as their inclinations demand, without being obliged to direct their special attention to any, further than are absolutely necessary for an Engineer Officer in the field under all circumstances; and the best method of affording that information would appear to be by establishing a system of halls of instruction in connexion with the establishment at Chatham, for such subjects as the following:—

Facilities for voluntary study.

Halls of instruction, model-rooms, &c.

Landscape Drawing.
Models in sand (for field-works, &c.)
Gunnery, and means for ordinary experiments in field-works to be granted on a liberal scale.
Submarine explosions.
Architecture, with plaister model-room, similar to that at the Ecole Polytechnique, Paris.
Machinery, with models, working and wood, assisted by explanatory drawings.
Geology and Mineralogy, with Museums (which would become valuable from Officers' contributions).
Chemistry, with Laboratory for Analytical Chemistry.

LIEUTENANT COWELL, R.E.

And lastly, it appears very desirable that the present course of surveying be extended, by practising rapid eye-sketching in the field.

Practice of rapid sketching.

The above, it is conceived, would be an advantageous method of imparting knowledge upon those subjects; and beyond its usefulness to young Officers, it would have the desirable effect of inducing Officers of Engineers, on their return from abroad, of directing their attention to those subjects in which they wish to improve themselves, together with having the advantages of an excellent library. The latter suggestion is made from their having no opportunity at present of prosecuting such studies with the facilities that this arrangement would afford, and from a conviction that something of the kind would be very desirable to most Officers. This step would, at the same time, tend very much towards the improval of the young Officers on going through their course, and the utility of such a system might be extended by its being, under certain regulations, open for the instruction of the private Sapper.

System to be open for the instruction of the private Sapper.

Senior Department not desirable.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

It does not appear at all desirable to have an institution similar to the Senior Department at Sandhurst for Officers of the Royal Engineers.

Duties during peace; attendance at professional operations; visits to foreign military works.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the efficient performance of their duties in time of war?

It appears desirable that their duties should be added to, by attending, at certain periods operations of a professional character, civil and military; that they should have greater facilities afforded them of visiting foreign countries, fortresses, and works of a military character, which at times would be attended with most valuable results to the Government. This would at the same time extend their knowledge of languages, and also their ideas on professional matters in other nations.

Union of the two corps or readjustment of their functions injurious to the service.

Question 8. Do you consider that any readjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two corps of the Artillery and the Engineers can be entertained as a question of education?

It is considered that a readjustment of the functions at present assigned to the Royal Artillery and Engineers would tend to injure the public service, and it is conceived that the union of the two corps cannot be entertained as a question of education.

Military College.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now determined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

It is considered most advantageous that, after the selection is made for the Engineers, from the gentlemen who pass at the public competitive examination, they should at once proceed to a Military College, where Fortification, Modern Languages, and some scientific studies should be taught; and also that amount of knowledge of gunnery, both theoretical and practical, which is indispensable to every Officer of Engineers. This would, with the qualifications they then possessed, occupy but a small proportion of the time they would remain at the College. Besides the above, they should receive instruction in drill and other military matters.

(Signed) J. C. COWELL,
Lieutenant Royal Engineers.

REPLIES AND RETURNS REFERRING TO THE ROYAL ENGINEER ESTABLISHMENT AT CHATHAM.

From Major-General Sir Frederic Smith, K.H., from R.E., formerly Director of the Royal Engineer Establishment, Chatham.

Major-General Sir F. Smith, K.H., from R.E.

Question 13. What, in your opinion, is the amount of mathematical knowledge which, according to the usual system (as pursued prior to the war) is requisite for passing, with advantage, through the course of study followed at Chatham?

I think that the amount of mathematical knowledge which the young Officers of Engineers usually brought with them to Chatham was sufficient when I was the Director.

Question 14. Do you consider that Officers are sufficiently instructed when they join at Chatham, either as regards the extent or the depth and accuracy of their knowledge, to enable them to follow the course with full advantage?

Yes; the existing course.

Question 15. Are there any subjects not at present taught at Chatham, which you think should be added to the course? or can you suggest any improvement in the general mode of instruction pursued?

Unless the time allowed for the Chatham course be lengthened, that course cannot be conveniently extended. The extension I would recommend would in a great degree, be of a practical nature.

Extension of the course at Chatham.

Question 16. In case of such improvements being effected, what additional amount of previous mathematical knowledge would become requisite?

Not any.

Question 17. Without reference to what may be the present state of teaching, what do you consider to be the education, both scientific and practical, which would most completely qualify an Officer of the Engineers for the discharge of his various duties?

This is a very large question. First of all, what are to be the duties of an Officer of Engineers? If he be required to be the architect in civil works, if I may use that expression as regards buildings, then a course of architecture should be gone through of a much higher order than that which is at present carried on at Chatham, and the students should, by careful and frequent inspections, become practically informed of the mode of executing great works.

The instruction in works of military engineering is far too limited at Chatham, and it is not of a high order. It consists of mere details in offensive siege works, and is not calculated to elevate the mind of the student. If more time were allowed, and the course extended to the higher branches of engineering, and a wholesome emulation produced, very satisfactory results would ensue.

In order to do justice to this subject, it would be necessary to discuss principles and numerous details, which would, perhaps, be here out of place, and I, therefore, think it becoming to refrain.

(Signed) Frederic Smith,
Major-General.

April 11, 1856.

From Colonel Sandham, R.E., Director of the Royal Engineer Establishment, Chatham.

Colonel Sandham, R.E.

Gentlemen, Royal Engineer Establishment, Chatham, April 22, 1856.

I beg to forward herewith answers to the printed questions sent to me with your letter dated Metz, March 11, 1856.

With reference to the letter itself, I would observe that the facilities at present given to Officers for attaining the knowledge required for the discharge of their

Colonel Sandham, R.E.

duties, previous to entering the army (which term I presume to apply especially to the Scientific Corps), are those that are derived from the theoretical, practical, and military education afforded them at the Royal Military Academy at Woolwich, the military part of which is of the greatest importance. Immediately after obtaining commissions, the facilities given to Officers of Engineers are described in the answers to the printed questions above referred to; but no facilities are afforded to them during the course of their service, beyond the experience they gain in the execution of their duties. I am of opinion that after an Officer has gone through his studies and duties, (theoretical and practical,) at Woolwich and at Chatham, facilities should be continued to him; he should have opportunities of travelling, and of visiting military and civil establishments and manufactories at home and abroad, afforded him; every inducement and every reasonable assistance should be given to him to enable him to collect information. Hitherto an Officer has had great difficulties to contend with in his endeavours to improve himself; scarcely an Officer of the corps could obtain leave of absence from his duties even for such an object; this, and the expenses of travelling and of collecting information, have almost entirely prevented his seeking information beyond what a library could afford. The measures best calculated to render the existing education still more efficient are to afford the Officers, after they have entered upon the general duties of the corps, a liberal assistance, and to grant them leave of absence to enable them to visit great works, to attend lectures on scientific subjects, and to collect information.

Travelling to be facilitated.

(Signed) H. Sandham,
Colonel Royal Engineers.

Origin of the establishment at Chatham.

Question 12. Will you have the goodness to inform the Commission with regard to the Establishment for Field Instruction at Chatham, 1st, of the causes and circumstances which led to its being set on foot; 2nd, of the principal changes which have been made from time to time in the instruction; 3rd, of the corresponding changes in the staff and establishment; 4th, of the nature of the instruction ordinarily afforded, previous to the late sudden demand for Officers; 5th, of the number of Officers, under ordinary circumstances, receiving instruction at the institution; 6th, of the number and functions of the persons engaged in superintending and communicating instruction; and 7th, of the amount of the total annual expense of the institution?

1st. "Of the causes and circumstances which led to the Establishment for Field Instruction at Chatham being set on foot."

Want of an engineer field equipment.

It was found in the Peninsular War, when regular sieges were to be undertaken, that operations of that nature were completely crippled for want of an engineer field equipment, and of a trained corps of Royal Sappers and Miners; this gave rise to the appointment of Major, now Lieutenant-General Sir Charles W. Pasley, under Royal Warrant, dated 23rd April, 1812, to instruct the corps of Royal Sappers and Miners, and the junior Officers of the corps of Royal Engineers, in the duties of sapping and mining, and other military field-works.

"Corps of Royal Military Artificers."

A working corps of handicraft men, called the Corps of Royal Military Artificers, had existed since 1772, which was under the immediate command of the Officers of the Royal Engineers, to whom they were of the greatest service in the execution of every species of work, and most especially so in the Colonies. Their military organization was confined to that of distinct companies, and they had no training in field operations whatever.

Organization and training of the Sappers and Miners.

Upon this corps the Royal Sappers and Miners were formed and organized, and their efficiency as artificers has not been impaired by their more careful training as soldiers; they have executed many superior works in England; and in the Colonies they have carried out works to completion where they could not have been undertaken for want of artificers and labourers; unless, indeed, by engaging them at home, and inducing them, at vast expense, to leave England; and then men so raised would carry with them all the disadvantages of being only under the weak control of an agreement, exposed to the temptations of higher wages, and of settlement, that are open to men of that class in a Colony.

In the corps of Royal Sappers and Miners, trained as they now are and have been since 1812, are combined the advantages of a superior military body of men, fit to undertake any military engineering operation, or to take their place in position as soldiers, and capable of executing any species of work that might be required of them at less cost than it could be done by civil labour.

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2nd. "Of the principal changes which have been made from time to time in the instruction."

Changes in the instruction after the Peace of 1815.

At first the instruction was almost entirely confined to the practical operations of a siege in the field, including sapping and mining, escalading, practice with hand grenades, passage of the ditch, &c., and pontooning; every Officer being obliged to produce a note-book of each operation in detail, made up from observation, previous to his leaving the establishment. After the Peace of 1815 was concluded, the course of instruction was extended, from time to time, to what it now is, viz.:—

I. To draw the plan of some memorable or remarkable French siege, and to translate the description of the operations in detail.

1. Plan of a siege.

II. To draw and prepare two projects of attack of given fortresses, the number of the garrison, of artillery, and means of defence being defined; laying down each day's operation, from the opening of the trenches to the passage of the ditch, and the reduction of the place; giving details and estimates of men for working parties and guards of trenches, of Engineers and Sappers, of artillery and ammunition, and of tools and materials, required for each day.

2. Projects of attack of given fortresses.

III. To prepare the following projects of demolition, with details and estimates of men, tools, materials, ammunition and of time:—

3. Projects of demolition.

1. Of a casemate or magazine.
2. Of a bridge.

These under two suppositions; one when economy of powder is desirable; the other when time is of importance.

3. Of a wharf wall or dock, requiring precautions against damp and water.

4. Of a front, or portion of a front of fortification, having revetments.

IV. To prepare projects of temporary bridges, boats, barges, or other vessels of given descriptions, and with given resources; of pontoons, casks, or rafts, with given conditions; for the passage of siege or field artillery, of cavalry and infantry, or of an army in the field, with all its accompaniments, across given rivers; with details and estimates of men, materials, and time required; with calculations of buoyancy, strength of timber, &c., and also for sheering or warping rafts for the passage of rivers.

4. Projects of bridges, &c.

V. To complete in detail a course of practical architecture, which embraces the nature and measurement of the work of each trade, with details and estimates of each, and with detailed and working drawings, with specifications for the completion of a building; showing also the comparative strength and value of building materials.

5. Detailed course of practical architecture.

VI. To complete, also, a course of surveying, both trigonometrical and special; of military reconnoitering and field sketching; of practical astronomy, of observing with astronomical instruments, and of instruction in the use of each instrument; of observing and noting from meteorological instruments.

6. Surveying, reconnoitering, and field sketching; practical astronomy and meteorological observation.

Each Officer goes through the above courses, and in addition they are encouraged to attend a chemical laboratory, which has been established since 1853. Many of the Officers practise Analytical Chemistry, and all are made acquainted with the manipulation and the use of the voltaic battery for military purposes. During the present year, instruction in the use of the field electric telegraph, and in the art of photography, has been added to the instruction.

Voluntary studies. (Analytical chemistry, electric telegraph and photography.)

The Officers are also taken to visit and examine civil private and public works; machinery, railways in progress, brickmaking, lime and cement kilns, &c. in the neighbourhood, by a Captain or Senior Officer. Of these works they are required to write descriptions from their own observations; and in all cases they are strictly enjoined never to be without their note-books, in which they are encouraged to make memoranda, in order to give them habits of observation.

Visits to civil works.

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3rd. "Of the corresponding changes in the Staff and Establishment."

Change in the Staff and Establishment.

Director and Adjutant, (1812). Assistant Director. Instructor in surveying, &c., (1833). In Analytical chemistry, (1853). Superintent of Surveying and Practical Astronomy.

When the establishment was first formed in 1812, the Staff consisted of a Director only, and an Adjutant was added in December of that year. In 1815 an Assistant Director was appointed, but the appointment was discontinued in 1821. In 1833, when the instruction in Surveying and in Practical Astronomy was ordered to be carried out at Chatham, an instructor was especially appointed for these duties, and an observatory was built. In 1852 a cook-house was converted into a chemical laboratory; and in 1853 Captain Scott, Royal Engineers, who was at that time one of the instructors of the Practical Class of Cadets in the Arsenal at Woolwich, was authorized to attend at Chatham weekly, to give instruction to the Officers and Men in Analytical Chemistry. In 1855 Captain Scott was appointed Superintendent of Surveying and Practical Astronomy, since which period he has taken charge of the chemical laboratory, and he continues to give instruction and lectures with much advantage to Men and Officers.

Assistant instructors in field-works, (1854).

In 1854 a Captain and a Lieutenant were added to the establishment as Assistant Instructors in Field-works.

Electric telegraph Instructors, (1856).

In 1856 a Captain of Royal Engineers was appointed to superintend the instruction of Men and Officers in the use and manipulation of the Electric and Magneto-Electric Telegraphs; and in the same year authority was granted for the instruction of five Non-commissioned Officers by Mr. Thurston Thompson, a celebrated photographist in London, with a view to their becoming instructors in the art of Photography at the Royal Engineer Establishment.

Removal to Chatham, (1856).

In January 1856 the head-quarters of the Royal Sappers and Miners was moved from Woolwich to Brompton Barracks, Chatham, and the following staff was authorized for the military duties and instruction at the establishment, viz.:—

Present Staff.

2 Adjutants.
2 Quartermasters.
3 Serjeant-Majors.
2 Quartermaster-Serjeants.
1 Staff Serjeant, Senior Clerk in the Director's Office.
6 Serjeants, as Instructors, Supernumeraries.

And for the general duties and recruiting of the corps, as Head-Quarter Staff,—

1 Assistant Adjutant-General.
1 Staff Serjeant, Senior Clerk in the Assistant Adjutant-General's Office.
2 Serjeants as Clerks in ditto.
2 Serjeants, Master Tailors, Supernumeraries.
2 ,, Drills.

Involving the following addition or changes in the Staff, consequent on the removal of the head-quarters of the corps from Woolwich to Chatham, viz.:—

1 Assistant Adjutant-General, instead of a Brigade Major.
1 Commissioned Adjutant, instead of an Acting Adjutant.
1 Additional Quartermaster.
1 Additional Serjeant-Major.
2 Staff Serjeants, on Serjeant's pay, as Clerks.
2 Serjeants, as Clerks.
6 Serjeants Instructors.
2 Serjeants, as Master Tailors.
2 Serjeants, as Drills.
} Supernumeraries.

4th. "Of the nature of the instruction ordinarily afforded, previous to the late sudden demand for Officers."

The extent of instruction ordinarily afforded is fully detailed in the answer to the second question in this paper; the nature of the instruction ordinarily afforded at the Royal Engineer Establishment is essentially practical.

5th. "Of the number of Officers, under ordinary circumstances, receiving instruction at the institution."

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The average number of Officers of Royal Engineers under instruction for the ten years between

1825 and 1835	6·3	per year.
1835 and 1845	9·6	„
1845 and 1855	17·8	„

Average number of officers under instruction.

The actual number at the present time, 18; and 4 have left since the commencement of 1856.

6th. "Of the number and functions of the persons engaged in superintending and communicating instruction."

Present number and functions of Instructors, &c.

1 Director. Commanding the corps at head-quarters; general direction and superintendence.

2 Adjutants. General duties, regimental, field, and drills; and schools.

1 Captain.
1 Lieutenant } Assistant Instructors in Fieldworks. These Officers also superintend the Officers in the Halls of Study, and the men in school.

1 Captain. Superintendent in Surveying and Practical Astronomy, Chemistry, and Civil Works; and in the Halls of Study.

1 Captain. Superintending the instruction in the Electric, the Magneto-Electric, and other Field Telegraphs.

The above Officers are permanently attached to the establishment. The Captains who may be stationed at head-quarters, in charge of companies, take part in the superintendence of their companies in the schools and in the field; and they are detailed for such special instruction to the Junior Officers as may be found most advantageous. One of the Captains is at present carrying out experiments with the voltaic battery; the other takes the Junior Officers to the Civil Engineering works alluded to in the answer to the second question in this paper. All the Senior Officers that belong to the establishment, or that may be quartered with it only for a time, whether Captains or Lieutenants, take part in the examination of the projects and exercises that the Junior Officers under instructions are called upon to execute; they make such remarks upon them as they think necessary, and bring them to the notice of the Officer concerned, pointing out any errors they may discover.

Two Serjeant-Majors are employed in regimental duties and drills, in field-work duties, in pontooning drill, and in all the instruction imparted to the men, in the schools and in the field, and in the model room.

One Serjeant-Major has more immediate charge of the drill of the recruits.

Six Supernumerary Serjeants are employed as instructors in the schools, and in field duties.

7th. "Of the amount of the total annual expense of the Institution."

The total annual expense of the Royal Engineer Establishment for the last ten years is shown below, for each year, viz.:—

1846–47	£3,141	1851–52	£3,939
1847–48	5,206	1852–53	3,929
1848–49	7,123	1853–54	4,440
1849–50	4,812	1854–55	5,182
1850–51	4,511	1855–56	6,150

The estimate for 1856–57 amounts to 13,182*l.*, consequent on the removal of head-quarters of the Royal Sappers and Miners from Woolwich to Chatham, and on the increase of Staff Non-commissioned Officers and Instructors.

(Signed) H. SANDHAM,
Colonel Royal Engineers, Director.

Question 13. What, in your opinion, is the amount of mathematical knowledge which, according to the usual system (as pursued prior to the war) is requisite for passing, with advantage, through the course of study followed at Chatham?

Pure Mathematics; Mixed Mathematics, as Statics, Dynamics, Hydrostatics.

Amount of mathematical knowledge necessary to enter on the course.

COLONEL SANDHAM, R E.

Officers on joining usually deficient in drawing.

Question 14. Do you consider that Officers are sufficiently instructed when they join at Chatham, either as regards the extent or the depth and accuracy of their knowledge, to enable them to follow the course with full advantage?

The Junior Officers on joining at Chatham are always at a loss to apply their knowledge; the accuracy of their knowledge, therefore, might be questioned. They are generally deficient in Drawing. They should have more practice and instruction in every description of Drawing, Figure, Landscape, Topographical, and Mechanical.

Subjects which might be added to the course.

Question 15. Are there any subjects not at present taught at Chatham, which you think should be added to the course? or can you suggest any improvement in the general mode of instruction pursued?

Geology, Analytical Chemistry, Photography, the use of the Electric Telegraph, and Book-keeping, which could be taught with the Architectural Course, —might be added to the course with advantage. I can suggest no improvements in the mode of instruction, which is essentially practical; and improvements are taken advantage of as they suggest themselves.

Question 16. In case of such improvements being effected, what additional amount of previous mathematical knowledge would become requisite?

None; but the facility of applying mathematical knowledge should be more attended to.

Necessary additions to the buildings at Chatham.

Question 17. Without reference to what may be the present state of teaching, what do you consider to be the education, both scientific and practical, which would most completely qualify an Officer of the Engineers for the discharge of his various duties?

As all Engineer Officers, on obtaining their commissions, commence their duties in a state of pupilage at Chatham, I consider it essential that a theatre for lectures, a proper chemical laboratory, and rooms for the electric telegraphic and photographic instruction, should be built; and that Officers of experience and acknowledged talents should be selected from the corps, and employed as instructors in the subjects that may be from time to time introduced into the course; such, for instance, as Geology, Mineralogy, Chemistry, Photography, the use of the Electric and other Telegraphs; and that Officers so selected and employed should receive a liberal remuneration during their employment as instructors; and I consider that placing every facility, and affording every reasonable assistance and encouragement to Officers of Engineers to enable them to collect and impart knowledge and information, without reference to their length of service, would tend more than anything to most completely qualify them for the discharge of their various duties. Great efforts have been made by the Officers of the corps, and they have been at great expense in forming purely professional libraries at all the Engineer stations at home and abroad; as well as in printing and publishing Corps Papers on professional subjects, which have established the scientific reputation of the corps, and show that there is no want of energy on their part.

Instructors to be appointed in the subjects added to the course.

(Signed) H. SANDHAM,
Colonel Royal Engineers, Director.

REPLIES AND RETURNS RELATING TO THE ROYAL MILITARY ACADEMY, WOOLWICH.

From MAJOR-GENERAL G. G. LEWIS, C.B., from R.E., LIEUT.-GOVERNOR.

Question 23. Have any alterations in the course of studies, or arrangement of hours been made since the issue of the printed regulations bearing date the 18th of August 1848?

See paper A.

Question 24. Will you have the goodness to furnish the Commission with a tabular statement of the average number of Cadets in the institution for every year since 1820, showing their average ages at the date of their admission, and at that of their receiving their commissions? Will you at the same time state the number who have annually obtained commissions in the Artillery and in the Engineers respectively, the strength of the two corps, as authorized by the Warrant, and their absolute strength for each year of the same period?

See paper B.

Question 25. Will you also furnish the Commission with a return of the number of Cadets annually removed from the Academy on account of incapacity during the last fifteen years, specifying the length of their residence before their removal, and stating, as far as you can, the nature of the deficiencies that occasioned it?

See paper C.

Question 26. Will you have the goodness to supply the following details of the last examinations, both in the Theoretical and in the Practical Class, of the Cadets (numbers being substituted for their names) who were respectively commissioned in the years 1847 and 1852; viz., 1st. Copies of the examination papers with the questions consecutively numbered in one series; 2nd. A statement of the credits each Cadet should have obtained in each branch of study, together with the credits actually obtained, marking by the numbers of the series mentioned above the questions answered by each; 3rd. A statement of their respective ages at the date of their admission, and of the actual amount of time during which they received instruction in the Theoretical and in the Practical Class?

See paper D.

Question 27. Will you also supply the Commission with a list of the various studies followed at the Academy prior to the commencement of the war, together with a detailed account of the Officers, Professors, and Masters, attached to the establishment for enforcing general discipline, and for carrying on the instruction? How is the discipline maintained during the hours of study?

See Regulations of Master-General of 1848. See paper A.

Question 28. Can you inform us of the number of Cadets, who, during the last fifteen years, have passed through the Theoretical Class in the course of two years? can you state their ages at the date of their admission to the Academy, and the extent of their mathematical knowledge when they joined and when they quitted?

See paper E.

Question 29. Will you furnish the Commission with a return showing the relative positions, at their last examinations, of the officers who have selected the Artillery, and of those who have selected the Engineers during the last fifteen years?

See paper F.

MAJOR-GENERAL LEWIS, C.B., from R.E.

RETURN of OFFICERS, PROFESSORS, and MASTERS attached to the ROYAL MILITARY ACADEMY, for enforcing GENERAL DISCIPLINE, and for carrying on the INSTRUCTION of the GENTLEMEN CADETS.

Royal Military Academy, Woolwich, April 26, 1856.

Lieutenant-Governor		Major-General G. G. Lewis, C.B., R.E.
Inspector		Colonel J. E. Portlock, R.E.
Assistant do.		Lieutenant-Colonel T. Elwyn, R.A.
Officers attached to the Cadet Company.	2nd Captain and Paymaster	Captain G. B. Shakespear, R.A.
	Do. for Practical Class	2nd Capt. P. D. Margesson, R.A.
	Lieutenant	William L. Younge, R.A.
	Do.	John L. Clarke, R.A.
	Do.	Thomas A. J. Harrison, R.A.
	Quartermaster	William Elliott, R.A.
	Chaplain	Rev. A. C. Fraser.

Professors and Masters.

Professor of Mathematics	J. J. Sylvester, Esq., F.R.S.
Mathematical Masters	J. R. Christie, Esq. W. Rutherford, Esq., LL.D. J. F. Heather, Esq. Stephen Fenwick, Esq. Rev. G. Y. Boddy. Wm. Raester, Esq. Rev. F. W. Vinter.
Professor of Fortification	Captain P. Bainbrigge, R.E.
1st Assistant in Fortification	2nd Capt. C. S. Hutchinson, R.E.
2nd do. do.	2nd Capt. J. Wilson, R.E.
Master for Descriptive Geometery	T. Bradley, Esq.
Do. for Geometrical Drawing	G. S. Pritchard, Esq.
2nd do.	Lieut. C. J. Durrah, R.E.
Drawing Master, for Landscape	J. Bridges, Esq.
2nd do do.	G. B. Campion, Esq.
Master for Military Plan Drawing and Sketching	Major J. Gore, retired R.A.
Instructor in Surveying and Field Works	2nd Captain C. R. Binney, R.E.
Assistant do. do. do.	Captain E. Palmer, R.A.
Instructor, Practical Artillery	Captain C. F. Young, R.A.
Assistant do. do.	2nd Captain and Brevet Major C. H. Owen, R.A.
French Master	Mons. A. Lovey.
Do.	Mons. A. de Charante.
Additional do.	Mons. L. Stievenard.
Do.	Mons. P. Barrère.
German Master	A. Troppaneger, Esq.
Do.	C. Feiling, Esq.
Additional do.	G. Solling, Esq.
Do.	F. Schlutter, Esq.
Master for History and Geography	Rev. G. Y. Body.
Lecturer on Chemistry	C. L. Bloxham, Esq.
„ Geology and Mineralogy	J. Tennant, Esq.
„ Mechanics and Metallurgy	T. M. Goodeve, Esq.

The various studies followed at the Royal Military Academy, both prior and subsequent to the commencement of the war, are fully detailed in pages 51 to 67 of the Rules and Regulations accompanying this Return; and the course therein prescribed has been adhered to strictly, with the exceptions marked in red ink. For the distribution of the hours of study, see paper A.

The discipline in study is maintained, in their respective rooms, by the professors and masters, assisted by a corporal or senior cadet detailed weekly for that purpose, the whole being under the authority of the Inspector, who visits the class rooms frequently during the hours of study, and is responsible to the Lieutenant-Governor that no deviation takes place from the system laid down in the General Rules accompanying this Return. *Vide* pages 8 to 10, and 34 to 37.

G. G. LEWIS, Major-General,
Lieutenant-Governor.

A.

DISTRIBUTION of STUDIES, showing in Red, the Alterations made since the 18th August 1848.

		First Class.	Second Class.	Third Class.	Fourth Class.	Fifth and Sixth Rooms. Landscape Drawing.	Practical Class.
Monday.	Morning.	Mathematics.	Mathematics.	Mathematics.	Mathematics.	....	Practical Artillery.
	Afternoon.	Mathematics.	Mathematics.	Mathematics.	Mathematics.	....	Practical Artillery.
	Evening.	French.	German.	French or German.	French or German.	....	~~Lecture on Geology and Mineralogy.~~ Practical Mechanics, Practical Astronomy and Metallurgy.
Tuesday.	Morning.	Mathematics ~~and Philosophical Lecture.~~	Mathematics ~~and Philosophical Lecture.~~	Mathematics.	Mathematics.	....	Practical Artillery.
	Afternoon.	~~Philosophical Lecture.~~ Plan Drawing.	~~History and Geography.~~ ~~Philosophical Lecture.~~	French or German.	French or German.	....	Practical Artillery.
	Evening.	~~History and Geography.~~ ~~Philosophical Lectures.~~	~~Plan Drawing.~~ ~~Philosophical Lecture.~~	French or German.	French or German.	....	Practical Artillery.
Wednesday.	Morning.	Mathematics ~~and Chemical Lecture.~~	Mathematics ~~and Chemical Lecture.~~	Mathematics.	Mathematics.	....	Practical Artillery ~~and Chemical Lecture.~~
	Afternoon.	Mathematics.	Mathematics.	Mathematics.	Mathematics.	....	~~Field Works.~~ Practical Instruction in Chemistry.
	Evening.	German.	French.	French or German.	French or German.	....	~~Lecture on Astronomy.~~ Course of Applied Chemistry.
Thursday.	Morning.	Fortification; Landscape Drawing to one-third of the Class.	Fortification and Descriptive Geometry; Landscape Drawing to one-third of the Class.	Geometrical Drawing.	Plan Drawing.	A Section from each of the four Classes.	Practical Artillery.
	Afternoon.	Fortification ~~and a Lecture on History and Geography to half of the Class.~~ Landscape Drawing to one-third of the Class	Fortification and Descriptive Geometry; ~~Lecture on History and Geography to half the Class.~~ Landscape Drawing to one-third of the Class	Plan Drawing.	Geometrical Drawing.	A Section from ~~the third and fourth Classes.~~ each of the four Classes	Surveying and Field Works.
	Evening.	French.	German.	History and Geography.	French or German.	....	~~Surveying.~~ Lecture on Geology and Mineralogy.
Friday.	Morning.	Fortification. Landscape Drawing to one-third of the Class.	Fortification and Descriptive Geometry; Landscape Drawing to one-third of the Class.	Geometrical Drawing.	Plan Drawing.	A Section from each of the four Classes.	~~Practical Artillery.~~ Surveying and Field Works.
	Afternoon.	Fortification and ~~a Lecture on History and Geography to half of the Class.~~ Landscape Drawing to one-third of the Class	Fortification and Descriptive Geometry; ~~Lecture on History and Geography to half of the Class.~~ Landscape Drawing to one-third of the Class.	Plan Drawing.	Geometrical Drawing.	A Section from ~~the third and fourth Classes.~~ each of the four Classes.	Field Works and Surveying.
	Evening.	German.	French.	French or German.	History and Geography.	....	Lecture on Machinery. Surveying and Field Works.
Saturday.	Morning.	Fortification; Landscape Drawing to one-third of the Class.	Fortification and Descriptive Geometry. Landscape Drawing to one-third of the Class.	Geometrical Drawing.	Plan Drawing.	A Section from each of the four Classes.	Surveying and Field Works.
	Afternoon.	Fortification. Landscape Drawing to one-third of the Class	Fortification and Descriptive Geometry; Landscape Drawing to one-third of the Class.	Plan Drawing.	Geometrical Drawing.	A Section from ~~the third and fourth Classes.~~ each of the four Classes.	Surveying and Field Works.

April 26, 1856.

(Signed) G. G. LEWIS, Major-General, Lieutenant-Governor.

MAJOR-GENERAL LEWIS, C.B., from R.E.

B.

RETURN showing the Average Number of Cadets at the Royal Military Academy for every Year from 1820 to 1855 inclusive, showing their Average Ages at Admission, and also on receiving their Commissions.

Royal Military Academy, Woolwich, April 26, 1856.

Year.	Average No. of Cadets.	Number Admitted during the Year.	Average Ages at Admission.		Number Commissioned.		Average Ages when Commissioned.		Remarks.
			Years.	Months.	Royal Artillery.	Royal Engineers.	Years.	Months.	
1820	147	18	14	6	6	2	20	8	
1821	145	5	15	2	5	1	21	4	
1822	140	7	15	11	4	..	22	1	The Practical Course occupied about 12 months during this period.
1823	136	8	16	..	2	2	22	8	
1824	124	8	15	9	6	5	23	5	
1825	66	24	14	8	28	26	22	9	
1826	58	45	14	5	3	6	19	7	
1827	85	33	14	1	..	2	20	2	
1828	94	30	14	3	16	5	18	1	
1229	107	34	15	6	8	2	17	10	
1830	126	44	14	8	13	4	18	11	
1831	132	53	14	6	24	7	19	1	
1832	133	36	15	3	21	4	18	2	
1833	124	29	14	4	19	9	18	4	
1834	114	30	14	3	17	6	17	11	
1835	108	39	14	4	18	7	18	4	
1836	100	14	15	..	17	5	18	2	The Practical Course occupied about 6 months during this period.
1837	87	46	15	7	11	17	17	5	
1838	111	60	15	9	7	6	17	7	
1839	115	64	15	6	30	16	17	9	
1840	123	55	15	7	9	11	18	7	
1841	153	88	15	8	12	6	18	5	
1842	160	73	15	5	29	11	18	8	
1843	183	70	15	7	45	13	18	6	
1844	181	60	16	..	29	11	18	8	
1845	185	42	16	..	21	14	18	9	
1846	187	91	16	..	41	23	18	11	
1847	201	104	15	..	67	34	18	8	
1848	195	76	14	7	29	12	18	..	
1849	205	56	14	7	35	4	18	5	The Practical Course during this period occupied about 12 months.
1850	200	55	14	11	35	6	18	7	
1851	183	38	14	11	30	6	18	3	
1852	169	55	14	9	32	7	19	1	
1853	180	63	14	11	24	11	18	11	
1854	195	78	14	10	50	20	18	5	5 to 9 months.
1855	186	96	14	8	56	27	17	1	3 to 4 months.

G. G. LEWIS, Major-General,
Lieutenant-Governor.

MAJOR-GENERAL LEWIS, C.B., from R.E.

C.

RETURN showing the Number of Gentlemen Cadets annually removed from the Royal Military Academy for Incapacity, between January 1, 1841, and December 31, 1855; Length of Residence before Removal; and the Nature of the Deficiencies which occasioned it.

Royal Military Academy, Woolwich, April 26, 1856.

Year.	Numbers substituted for Names.	Length of Residence.		Nature of Deficiencies.
		Years.	Months.	
1841	1	1	—	General deficient progress.
	2	1	—	
	3	1	—	Mathematics.
	4	1	—	
	5	—	7	
	6	—	7	
	7	—	7	General deficient progress.
	8	—	7	
	9	—	7	
	10	—	4	
	11	—	4	
	12	—	4	
	13	—	4	
	14	—	4	
	15	—	4	Do. do.
	16	—	4	
	17	—	4	
	18	—	4	
	19	—	4	
	20	—	4	
1842	1	2	7	Deficient in Mathematics.
	2	1	7	,, Fortification.
	3	1	—	,, Do. and Mathematics.
	4	1	4	,, Do.
	5	—	10	,, Mathematics.
	6	—	10	,, Do.
	7	—	10	,, Do. and Fortification.
	8	—	10	Mathematics.
1843	1	1	7	Fortification.
	2	1	1	Spelling and Writing.
1844	1	2	11	General deficient progress.
	2	2	10	Do. do.
	3	1	1	Mathematics.
	4	1	1	Do.
	5	1	1	Do.
	6	1	1	Do.
	7	1	1	Do.
	8	1	1	Do. and Fortification.
	9	1	1	Do.
1845	1	1	1	Fortification.
1847	1	1	1	Mathematics and Fortification.
	2	1	1	Do. do.
	3	1	5	Mathematics.
1848	1	1	1	Mathematics, Fortification, French.
	2	1	1	Mathematics.
	3	1	1	Do.
1849	1	1	9	Mathematics.
	2	1	7	Do.
	3	1	3	Do. and Fortification.
	4	1	3	Mathematics.
	5	1	3	Do.
	6	1	3	Do.
	7	1	1	Do.

MAJOR-GENERAL LEWIS, C.B., from R.E.

Return showing the Number of Gentlemen Cadets, &c.—*continued.*

Year.	Numbers substituted for Names.	Length of Residence.		Nature of Deficiencies.
		Years.	Months.	
1849	8	1	1	Mathematics, Fortification, French, and History.
	9	1	1	Do., French, German, and History.
	10	1	1	Mathematics.
1850	1	3	1	General deficient progress.
	2	3	1	Do. do.
	3	2	10	Do. do.
	4	2	9	Do. do.
	5	2	7	Do. do.
	6	2	7	Do. do.
	7	2	7	Do. do.
	8	2	7	Do. do.
	9	2	7	Do. do.
	10	1	7	Fortification and Mathematics.
	11	1	7	Do. do.
	12	1	7	Mathematics and Fortification.
	13	1	7	Do. do.
	14	1	7	Do. do.
	15	1	1	Do. do.
	16	1	1	Mathematics.
	17	1	1	Do. and Fortification.
1851	1	3	1	General deficient progress.
	2	2	1	Do. do.
	3	2	7	Do. do.
	4	3	1	Do. do.
	5	2	7	Do. do.
	6	1	7	Mathematics.
	7	1	1	Do. and Fortification.
	8	1	1	Mathematics.
	9	1	1	Do. and Fortification.
	10	1	1	Do. do.
	11	3	1	General deficient progress.
1852	1	3	7	Do. do.
	2	2	1	Do. do.
	3	2	1	Do. do.
	4	2	1	Do. do.
	5	1	1	Mathematics.
	6	1	1	Do. and Fortification.
	7	1	1	Mathematics.
	8	1	7	Do. and French.
1853	1	—	10	Mathematics and Fortification.
	2	—	10	Do. do.
	3	1	1	Do. do.
	4	1	1	Do. do.
	5	1	1	Do. do.
1854	1	1	7	Mathematics.
1855	1	1	2	Mathematics and Fortification.
	2	—	10	Mathematics.
	3	—	8	General deficient progress.
	4	—	8	Do. do.
	5	—	8	Do. do.

(Signed) G. G. LEWIS, Major-General,
Lieutenant-Governor.

D.

RETURN to accompany the Printed Examination Papers of the last Sessions of the Years 1851 and 1852, showing the Number of Credits which each Gentleman obtained, and those which he ought to have gained at those Examinations; also their Ages at Admission, and the Period during which they received instruction, both in Practical and Theoretical Classes.—Royal Military Academy, April 1856.

—	Age at Admission.		Theoretical Examination, November 1851.											Practical Examination, December 1852.											—
			Mathematics.		Fortification.		French, Highest Credit, 1300.	German, Highest Credit, 1300.	Landscape Drawing, Highest Credit, 1200.	Plan Drawing, Highest Credit, 1200.	History and Geography, Highest Credit, 1300.	Period in Theoretical Class.		Practical Artillery, Highest Credit, 4400.	Surveying, Highest Credit, 2000.	Field Works, Highest Credit, 1200.	French, Highest Credit, 300.	German, Highest Credit, 300.	Geology and Mineralogy, Highest Credit, 400.	Mechanics and Machinery, Highest Credit, 400.	Chemistry, Highest Credit, 400.	Astronomy, Highest Credit, 400.	Period in Practical Class.		
	Years.	Months.	Credits gained.	Credits which ought to have been gained.	Credits gained.	Credits which ought to have been gained.						Years.	Months.										Year.	Month.	
1	14	7	3710	4980	1770	2830	1040	853	398	520	1010	3	1	3783	1621	1027	230	213	345	387	199	308	1	—	For questions, Thoeritical Examination, see Book No. 1.
2	14	8	4135	4980	1810	2830	980	564	690	785	660	2	10	3200	1579	1011	100	183	370	383	214	313	1	—	
3	14	3	2350	4560	2270	3650	560	406	900	890	570	2	10	3685	1612	942	90	107	330	375	179	172	1	—	
4	14	1	3950	5050	2090	3270	1020	428	673	800	890	2	10	3685	1622	946	120	171	370	390	221	277	1	—	
5	14	3	2550	3570	2190	3270	960	603	602	710	940	3	7	3586	1626	1023	120	159	356	365	202	230	1	—	
6	15	3	1580	2980	2200	3270	1300	875	830	710	570	3	7	3163	1369	771	280	195	300	385	130	210	1	—	
7	15	4	1870	2980	1640	3270	980	384	395	520	830	3	1	3276	1479	874	210	121	370	355	149	285	1	—	For questions, Practical Examination, see Book No. 2.
8	14	1	1805	2960	1900	3270	680	943	880	870	750	3	1	2540	1528	701	50	206	385	399	115	223	1	—	
9	14	4	1885	2940	1580	2700	1160	581	600	890	551	2	7	3298	1223	823	300	163	365	374	135	128	1	—	
10	14	3	2040	2940	1860	2940	980	277	780	940	610	4	1	2835	1433	717	110	118	390	370	123	110	1	—	
11	15	–	1965	2940	2000	3170	760	243	495	840	551	4	1	3011	1394	880	100	105	375	340	68	150	1	—	
12	14	8	1780	2940	1620	2970	1060	397	728	740	580	3	7	2897	1394	862	200	127	365	378	143	174	1	—	
13	14	7	1715	2940	1630	2700	1040	875	825	920	420	2	7	2992	1344	877	220	192	340	297	85	150	1	—	
14	14	4	1535	2940	1890	3170	840	341	930	1020	500	3	9	2955	1370	781	90	90	360	299	80	248	1	—	
15	14	3	2235	2970	2220	3650	860	127	827	800	400	4	1	3123	1217	671	140	77	350	300	40	106	1	—	
16	14	11	1915	4560	1830	3670	840	226	790	680	640	3	7	2958	1295	847	200	105	300	310	79	155	1	—	
17	14	2	2230	2940	1720	2830	920	572	490	690	400	3	1	2360	1303	903	90	166	280	305	34	192	1	—	
18	14	9	1630	2940	1640	2970	960	649	615	625	1000	3	1	2494	1259	798	120	162	285	295	39	70	1	—	
19	14	1	1915	2940	1410	2700	920	307	700	680	620	4	1	3150	1160	776	160	86	320	290	55	70	1	—	
20	15	6	1645	2940	1530	2700	960	311	670	840	570	3	7	2180	1001	726	170	102	310	280	28	70	1	—	

This Return embraces only those gentlemen who were commissioned in December 1852; the questions proposed at the other examinations in this year, as also those the year 1847, not being on record. The value assigned to each question, and the number of questions which each gentleman answered cannot now be ascertained.

(Signed) G. G. LEWIS, Major-General, Lieut.-Governor.

MAJOR-GENERAL LEWIS, C.B., from R.E.

MAJOR-GENERAL LEWIS, C.B., from R.E.

E.

RETURN of Gentlemen Cadets who have passed through the Theoretical Class in the Course of Two Years, from 1st January 1841 to 31st December 1855, showing their Ages at Admission, and extent of Mathematical Knowledge when they joined and when they quitted.

Royal Military Academy, Woolwich, April 28, 1852.

Year.	Numbers substituted for Names.	Corps to which appointed.		Age at Admission.		Extent of Mathematical Knowledge.	
		Royal Artillery.	Royal Engineers.	Years.	Months.	On Joining.	On Quitting.
1841	1	–	1	15	9	Equations - - Euc. b. ii	Diff. and int. calculus—Pendulums.
	2	1	–	15	7	Cub. equa. - - „ vi.	Dynamics—Unif. accel. motions.
	3	–	1	15	3	Astron. def. - Pl. and Solids	App. diff. and int. calculus.
	4	–	1	15	5	Sph. Trig. - „ „	Ditto ditto.
1842	1	–	1	16	4	Theor. of equa. - Euc. b. v.	Equilibrium of roofs and arches.
	2	1	–	15	5	Equations, equal roots „ ii.	Mechanical powers.
	3	–	1	16	4	Quad. equa. - „ iv.	Projectiles.
	4	–	1	15	1	Ditto - - „ iv.	Ditto.
	5	1	–	15	5	Ditto - - „ iv.	Dynamics—Projec., pract. rules gunnery.
	1	–	1	15	–	Cubic equa. - „ iv.	Integral calculus.
	2	–	1	16	8	Theor. of equa. - „ vi.	Projectiles.
	3	–	1	15	3	Cube root - - „ iii.	Ditto.
	4	–	1	16	8	Ditto - - „ iii.	Integral calculus—Pendulums.
	5	–	1	16	4	Ditto - - „ iii.	Projectiles—Impact.
	6	–	1	15	2	Ditto - - „ iii.	Integral calculus.
	7	–	1	15	4	Equations, equal roots „ ii.	Projectiles—Diff. calculus.
1843	8	1	–	15	2	Theor. of log. - „ v.	Integral calculus.
	9	1	–	15	2	Cube root - - „ iii.	Ditto.
	10	1	–	15	2	Ditto - - „ iii.	Projectiles.
	11	1	–	15	2	Ditto - - „ iii.	Ditto.
	12	1	–	16	7	Ditto - - „ iii.	Mechanics—Projectiles.
	13	1	–	16	7	Hind's Arith. - „ iv.	Lever—Composition of forces.
	14	1	–	16	7	Ditto - - „ iv.	Centre of gravity.
	15	1	–	15	4	Equations, equal roots „ iv.	Projectiles—Diff. calculus.
	16	1	–	15	5	Quad. equ. - - „ iv.	Ditto ditto.
1844	1	1	–	15	1	Prob. prod. equ. - „ i.	Projectiles—Collision of bodies.
	2	1	–	15	2	Theor. of logs. - „ iv.	Ditto ditto.
1845	1	–	1	15	–	Mensuration - „ vi.	App. of sph. trig. to astron. probs.
1846	1	–	1	16	4	Piling of shot - „ iv.	Mechanics—Projectiles.
	2	–	1	15	5	Heights and distances „ vi.	Integral calculus.
	1	–	1	16	10	Trigonometry - Planes	Projectiles.
	2	–	1	16	4	Indet. coeff. - Euc. b. v.	Ditto.
	3	–	1	16	2	Trigonometry - Planes	Ditto.
	4	–	1	16	8	Ditto - - „	Ditto.
	5	–	1	15	10	Ditto - - „	Ditto.
	6	–	1	15	10	Ditto - - „	Ditto.
	7	–	1	16	2	Experimental equ. Euc. b. v.	Ditto.
	8	–	1	16	7	Bin. theorem - „ vi.	Ditto.
	9	–	1	15	1	Ditto - - „ vi.	Mechanics—Projectiles.
	10	–	1	16	11	Ditto - - „ vi.	Ditto ditto.
	11	–	1	16	4	Scales of notation - „ vi.	Integral calculus.
	12	–	1	15	1	Quest. prod. quad. equ. „ v.	Projectiles.
	13	–	1	15	4	Ditto - - „ v.	Ditto.
	14	–	1	15	3	Scales of notation - „ vi.	Ditto.
	15	–	1	15	11	Ditto - - „ v.	Ballistic pendulum.
	16	–	1	16	4	Trigonometry - „ vi.	Diff. calculus.
1847	17	1	–	16	3	Ditto - - Planes	Projectiles.
	18	1	–	16	9	Indeter. coeff. - Euc. b. v.	Pullies.
	19	1	–	16	4	Piling of shot - „ v.	Ditto.
	20	1	–	16	4	Indeter. coeff. - „ v.	Ditto.
	21	1	–	15	4	Piling of shot - „ v.	Lever.
	22	1	–	15	2	Ditto - - „ vi.	Pullies.
	23	1	–	16	2	Bin. theorem - „ vi.	Projectiles.
	24	1	–	16	8	Permut. and comb. „ vi.	Ditto.
	25	1	–	16	7	Indeter. coeff. - „ iv.	Centre of gravity.
	26	1	–	15	6	Div. of alg. - - „ iv.	Pullies.
	27	1	–	16	7	Indeter. coeff. - „ iv.	Ditto.
	28	1	–	15	8	Arith. Prog. - „ iv.	Projectiles.
	29	1	–	16	9	Ditto - - „ iv.	Wheel and axle.
	30	1	–	16	9	Ditto - - „ iv.	Projectiles.
	31	1	–	16	7	Indeter. coeff. - „ vi.	Mechanics—Projectiles.
	32	1	–	16	6	Horner's equ. - „ iv.	Ditto—Lever.
	33	1	–	16	2	Bin. theorem - „ vi.	Projectiles.
	34	1	–	16	3	Quad. equ. - - „ v.	Comp. and resolution of forces.
	35	1	–	15	11	Scales of notation - „ vi.	Projectiles.
	36	1	–	16	–	Ditto - - „ vi.	Ditto.
	37	1	–	16	1	Ditto - - „ v.	Ballistic pendulum.
	38	1	–	16	1	Quad. equ. - - „ v.	Projectiles.
1848	1	1	–	14	10	Imaginary quant. - „ v.	Mens. of planes—Analyt. geom.
	2	1	–	15	3	Decomp. of alg. fract. „ iv.	The Pulley.
	3	1	–	15	2	Ditto - - „ v.	Mechanics—Virtual velocities.
	4	1	–	16	8	Ditto - - „ v.	Mens. of planes—Analyt. geom.
	5	1	–	15	5	Gen. solut. of equ. „ v.	Ditto Solids.
	6	1	–	15	9	Geom. prog. - „ iv.	Ditto Planes.
	7	1	–	15	6	Decomp. of alg. fract. „ iv.	Ditto Solids.
	8	1	–	15	10	Logarithms - „ iv.	Mechanics—Virtual velocities.
	9	1	–	16	1	Decomp. of alg. fract. „ v.	Ditto ditto.
	10	1	–	15	4	Contin. alg. fract. „ iv.	Mens. of planes—Analyt. geom.
	11	1	–	16	7	Decomp. alg. fract. „ v.	Mensuration of solids.
	12	1	–	16	5	Geom. prog. - „ vi.	Ditto of planes—Analyt. geom.
	13	1	–	15	4	Decomp. alg. fract. „ v.	Ditto of solids.

RETURN of Gentlemen Cadets, &c.—*continued.*

Year.	Numbers substituted for Names.	Corps to which appointed.		Age at Admission.		Extent of Mathematical Knowledge.	
		Royal Artillery.	Royal Engineers.	Years.	Months.	On Joining.	On Quitting.
	14	1	–	15	10	Gen. solut. of equ. Euc. b. v.	Mensuration of planes—Analyt. geom.
	15	1	–	15	–	Quad. equat. - „ v.	Ditto ditto.
	16	1	–	16	6	Bin. theorem - „ iv.	Mechanical powers—Screw.
	17	1	–	16	9	Logarithms - „ iii.	Ditto ditto.
	18	1	–	15	4	Scales of notation - „ ii.	Trigonometry.
	19	1	–	16	11	Permut. and combin. „ ii.	Mechanical powers—Screw.
	20	1	–	16	9	Piling of shot - „ iv.	Projectiles.
	21	1	–	16	–	Div. algebra - „ v.	Ditto.
	22	–	1	16	6	Cub. p. 425 - Disc. geom.	Cent. of gravity—Integral calculus.
1848	23	–	1	16	4	Logarithms - - Euc. b. vi.	Diff. calculus.
	24	–	1	16	1	Alg simplification „ ii.	Mensuration of solids.
	25	–	1	15	10	Ditto - - „ ii.	Mechanics—Projectiles.
	26	–	1	15	–	Quad. equ. - - „ iii.	Ditto—the Screw.
	27	–	1	15	3	Permut. and combinat. „ iii.	Mensuration of surfaces.
	28	–	1	16	6	Logarithms - „ iv.	Mechanics—Rotation of bodies.
	29	–	1	15	–	Ditto - - „ iv.	Ditto—Projectiles.
	30	–	1	16	4	Ditto - - „ iii.	Rotation of bodies.
	31	–	1	16	6	Ditto - - „ iv.	Ditto.
	32	–	1	16	2	Ditto - - „ v.	Ditto.
	33	–	1	16	10	Bin. theorem - „ iv.	Mechanical powers.
	1	–	1	15	10	Logarithms - „ vi.	Mechanics—Comp. and resol. of forces.
	2	–	1	15	7	Ditto - - „ vi.	Ditto ditto.
	3	–	1	15	11	Duodecimals - „ iii.	Ditto—Lever.
	4	–	1	15	5	Logarithms - „ vi.	Ditto ditto.
	5	1	–	14	–	Quad. equ. - - „ v.	Mensuration of solids.
	6	1	–	15	5	Surds - - „ ii.	Ditto of planes.
	7	1	–	15	4	Simple equ. - - „ ii.	Mensuration questions.
	8	1	–	15	6	Evolution - - „ iv.	Mechanics—Inclined plane.
	9	1	–	15	3	Logarithms - - „ vi.	Ditto ditto.
	10	1	–	14	2	Simple equ. - „ ii.	Mensuration of solids.
	11	1	–	15	–	Ditto - - „ iii.	Mensuration questions.
1849	12	1	–	14	11	Bin. theorem - „ iv.	Mechanics—Inclined plane.
	13	1	–	14	7	Logarithms - „ vi.	Ditto ditto.
	14	1	–	15	5	Bin. theorem - „ iv.	Mensuration of solids.
	15	1	–	15	–	Logarithms - „ vi.	Mechanics—Inclined plane.
	16	1	–	15	6	Ditto - „ vi.	Mensuration of surfaces.
	17	1	–	15	4	Solut. of equ. - „ iv.	Ditto of solids.
	18	1	–	16	2	Quad. equ. - „ v.	Mechanics—Centre of gravity.
	19	1	–	15	10	Contin. alg. fract. „ v.	Mensuration questions.
	20	1	–	16	5	Ditto - - „ iv.	Ditto—Planes.
	21	1	–	15	5	Geom. prog. - „ v.	Ditto—Questions.
	22	1	–	15	7	Contin. alg. fract. „ iv.	Ditto ditto.
	23	1	–	16	3	Sol. of equation - „ iv.	Ditto ditto.
	1	1	–	14	6	Logarithms - - „ vi.	Mechanics—Movement of forces.
	2	1	–	15	1	Quad. equ. - „ v.	Mensuration finished.
1850	3	1	–	14	3	Ditto - - „ v.	Ditto ditto.
	4	1	–	14	11	Logarithms - - „ vi.	Mechanics—Movement of forces.
	5	1	–	14	2	Quad. equ. - „ vi.	Mensuration finished.
1851	1	–	1	14	3	Ditto - - „ iv.	Diff. and int. calculus.
1852							
1853	–	–	–	–	–	——	——
1854	–	–	–	–	–	——	——
	1	–	1	15	10	Qu. prod. quad. equ. „ iv.	Dynamics.
	2	–	1	15	–	Indeter. analysis - „ iii.	Ditto.
	3	–	1	15	4	Bin. theorem - „ iii.	Ditto.
	4	–	1	14	4	Surds - - „ iv.	Ditto.
	5	–	1	15	5	Indeter. analysis - „ iv.	Ditto.
	6	–	1	14	8	Quad. equ. - „ iv.	Hydrostatics.
	7	–	1	14	5	Alg. fract. - - „ iii.	Ditto.
	8	1	–	15	4	Indeter. analysis - „ iv.	Integral calculus.
	9	1	–	14	9	Harmonic prog. - „ iv.	Dynamics.
	10	–	1	14	1	Ditto - - „ iv.	Statics.
	11	–	1	15	1	Quad. equ. - - „ iii.	Dynamics.
	12	1	–	15	11	Logarithms - - „ iv.	Ditto.
	13	1	–	14	6	Surds - - „ iii.	Hydrostatics.
	14	1	–	15	10	Geom. prog. - „ ii.	Dynamics.
	15	1	–	14	9	Ditto - - „ iii.	Ditto.
	16	1	–	14	8	Simp. equ. - - „ iii.	Ditto.
1855	17	1	–	14	11	Quad. equ. - - „ ii.	Statics.
	18	1	–	15	7	Ditto - - „ ii.	Dynamics.
	19	1	–	14	7	Ditto - - „ i.	Ditto.
	20	1	–	15	11	Ditto - - „ ii.	Ditto.
	21	–	1	15	10	Ditto - - „ ii.	Ditto.
	22	1	–	14	9	Alg. fract. - - „ i.	Ditto.
	23	1	–	14	10	Ditto - - „ ii.	Ditto.
	24	–	1	14	8	Quad. equ. - - „ ii.	Ditto.
	25	–	1	15	6	Ditto - - „ ii.	Statics.
	26	–	1	14	8	Alg. fract. - - „ ii.	Dynamics.
	27	–	–	14	3	Ditto - - „ ii.	Ditto.
	28	–	1	14	8	Ditto - - „ ii	Ditto.
	29	1	–	14	10	Logarithms - - „ iv.	Diff. calculus.
	30	–	1	15	9	Geom. prog. - „ iii.	Dynamics.
	31	1	–	15	9	Ditto - - „ iii.	Ditto.
	32	–	1	15	11	Ditto - - „ iii.	Ditto.
	33	1	1	15	1	Ditto - - „ iii.	Ditto.

(Signed) G. G. LEWIS, Major-General, Lieut.-Governor.

MAJOR GENERAL LEWIS, C.B., from R.E.

F.

RETURN showing the relative Positions at their last Examinations of those Officers who have been appointed to the Royal Artillery, and of those who have been appointed to the Royal Engineers, between the Years 1841 and 1855, inclusive.

Royal Military Academy, April 26, 1856.

Date.	Total Number Commissioned.	No. in each Corps.		Position of those appointed to the Royal Engineers.
		Royal Artillery.	Royal Engineers.	
1841, June	18	12	6	1, 2, 3, 4, 8, 14.
1842, Jan.	22	15	7	1 to 7.
„ June	18	14	4	1, 2, 6, 11.
1843, Jan.	16	13	3	1, 2, 3.
„ June	20	15	5	1, 2, 3, 4, 6.
„ Dec.	22	17	5	1, 2, 3, 4, 5.
1844, June	20	15	5	1 to 5.
„ Dec.	20	14	6	1, 3, 4, 5, 12, 17
1845, June	15	11	4	1, 2, 4, 5.
„ Dec.	20	10	10	1 to 7, 9, 11, 18.
1846, May	21	13	8	1, 2, 6, 7, 9, 11, 15, 21.
„ Aug.	23	15	8	3, 6, 8, 10, 11, 12, 15, 17.
„ Dec.	20	13	7	1, 3, 6, 7, 8, 13, 17.
1847, May	22	14	8	1 to 8.
„ Oct.	41	28	13	2, 3, 4, 5, 6, 9, 10, 11, 13, 15, 16, 18, 27.
„ Dec.	39	26	13	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14.
1848, June	20	10	10	3 to 12.
„ Dec.	20	18	2	1, 2.
1849, June	20	18	2	1, 5.
„ Dec.	19	17	2	1, 2.
1850, June	21	18	3	1, 2, 3.
„ Dec.	20	17	3	1, 2 3.
1851, June	15	13	2	1, 2.
„ Dec.	21	17	4	1, 2, 3, 4.
1852, June	19	15	4	1 to 4.
„ Dec.	20	17	3	2, 3, 5.
1853, April	2	2	..	
„ June	15	9	6	1, 2, 4, 6, 7, 8.
„ Dec.	18	13	5	1, 2, 4, 6, 7.
1854, April	16	14	2	1, 2.
„ Aug.	22	14	8	1, 2, 3, 4, 5, 6, 7, 9.
„ Oct.	22	15	7	1, 2, 3, 5, 6, 7, 8.
„ Dec.	10	7	3	1, 2, 4.
1855, Feb.	27	18	9	1, 2, 4, 6, 7, 8, 9, 10, 11.
„ April	20	13	7	2, 4, 5, 6, 7, 8, 9.
„ Aug.	18	10	8	1, 2, 3, 4, 5, 6, 7, 17.
„ Oct.	8	8	..	
„ Dec.	10	7	3	1, 2, 3.

(Signed) G. G. LEWIS, Major-General, Lieutenant-Governor.

G.

Order.	1841.		1842.				1843.						1844.				1845.				1846.						1847.						1848.			
	June.		January.		June.		January.		June.		December.		June.		December.		June.		December.		May.		August.		December.		May.		October.		December.		June.		December.	
	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.
1	R.E.	28	R.E.	44	R.E.	28	R.E.	35	R.E.	28	R.E.	28	R.E.	52	R.E.	43	R.E.	34	R.E.	40	R.E.	36	R.A.	48	R.E.	25	R.E.	36	R.A.	53	R.E.	20	R.A.	35	R.E.	25
2	R.E.	25	R.E.	42	R.E.	34	R.E.	35	R.E.	28	R.E.	31	R.E.	31	R.A.	40	R.E.	28	R.E.	37	R.E.	36	R.A.	54	R.A.	43	R.E.	30	R.E.	29	R.E.	20	R.A.	40	R.E.	25
3	R.E.	28	R.E.	42	R.A.	40	R.E.	29	R.E.	25	R.E.	46	R.E.	46	R.E.	31	R.A.	34	R.E.	40	R.A.	39	R.E.	44	R.E.	31	R.E.	24	R.E.	29	R.E.	29	R.E.	23	R.A.	23
4	R.E.	40	R.E.	44	R.A.	34	R.A.	26	R.E.	25	R.E.	31	R.E.	31	R.E.	40	R.E.	43	R.E.	34	R.A.	42	R.A.	39	R.A.	49	R.E.	48	R.E.	35	R.E.	29	R.E.	23	R.A.	25
5	R.A.	40	R.E.	35	R.A.	37	R.A.	35	R.A.	34	R.E.	29	R.E.	34	R.E.	52	R.E.	37	R.E.	37	R.A.	42	R.A.	42	R.A.	46	R.E.	30	R.E.	35	R.E.	20	R.E.	23	R.A.	25
6	R.A.	40	R.E.	32	R.E.	28	R.A.	34	R.E.	28	R.A.	34	R.A.	37	R.A.	43	R.A.	49	R.E.	37	R.E.	36	R.E.	30	R.E.	37	R.E.	36	R.E.	31	R.E.	22	R.E.	23	R.A.	25
7	R.A.	46	R.E.	47	R.A.	37	R.A.	29	R.A.	31	R.A.	34	R.A.	43	R.A.	46	R.A.	46	R.E.	37	R.E.	45	R.A.	45	R.E.	31	R.E.	36	R.A.	35	R.E.	37	R.E.	23	R.A.	32
8	R.E.	37	R.A.	42	R.A.	47	R.A.	35	R.A.	28	R.A.	40	R.A.	37	R.A.	43	R.A.	49	R.A.	43	R.A.	51	R.E.	42	R.E.	31	R.E.	42	R.A.	53	R.A.	25	R.E.	23	R.A.	25
9	R.A.	43	R.A.	35	R.A.	31	R.A.	38	R.A.	24	R.A.	46	R.A.	28	R.A.	37	R.A.	34	R.E.	40	R.E.	42	R.A.	30	R.A.	43	R.A.	42	R.E.	29	R.E.	20	R.E.	28	R.A.	25
10	R A	35	R.A.	34	R.A.	49	R.A.	29	R.A.	38	R.A.	37	R.A.	34	R.A.	49	R.A.	37	R.A.	40	R.A.	54	R.E.	39	R.A.	37	R.A.	51	R.E.	35	R.E.	37	R.E.	23	R.A.	25
11	R.A.	40	R.A.	42	R.E.	28	R.A.	35	R.A.	46	R.A.	46	R.A.	40	R.A.	40	R.A.	37	R.E.	40	R.E.	42	R.E.	30	R.A.	31	R.A.	42	R E.	35	R.E.	31	R.E.	23	R.A.	23
12	R.A.	46	R.A.	35	R.A.	28	R.A.	56	R.A.	28	R.A.	40	R.A.	37	R.E.	40	R.A.	37	R.A.	55	R.A.	42	R.E.	33	R.A.	52	R A.	30	R.A.	29	R.E.	20	R.E.	23	R.A.	23
13	R.A.	40	R.A.	42	R.A.	34	R.A.	41	R.A.	31	R.A.	34	R.A.	28	R.A.	34	R.A.	46	R.A.	37	R.A.	51	R.A.	30	R.E.	35	R.A.	30	R.E.	29	R.E.	22	R.A.	26	R.A.	25
14	R.E.	35	R.A.	32	R.A.	31	R.A.	35	R.A.	43	R.A.	46	R.A.	37	R.A.	43	R.A.	34	R.A.	49	R.A.	51	R.A.	30	R.A.	52	R.A.	30	R.A.	29	R.E.	37	R.A.	23	R.A.	25
15	R.A.	40	R.A.	37	R.A.	34	R.A.	35	R.A.	43	R.A.	28	R.A.	37	R.A.	37	R.A.	43	R.A.	37	R.E.	42	R.E.	39	R.A.	43	R.A.	30	R.E.	41	R.A.	25	R.A.	23	R.A.	25
16	R.A.	35	R.A.	29	R.A.	37	R.A.	26	R.A.	49	R.A.	34	R.A.	37	R.A.	37	–	–	R.A.	40	R.A.	42	R.A.	33	R.A.	31	R.A.	36	R.E.	29	R.A.	31	R.A.	23	R.A.	25
17	R.A.	38	R.A.	44	R.A.	37	–	–	R.A.	28	R.A.	31	R.A.	52	R.E.	31	–	–	R.A.	40	R.A.	54	R.E.	27	R.E.	25	R.A.	42	R.A.	26	R.A.	31	R.A.	32	R.A.	25
18	R.A.	49	R.A.	35	R.A.	22	–	–	R.A.	40	R.A.	37	R.A.	37	R.A.	37	–	–	R.E.	28	R.A.	45	R.A.	39	R.A.	37	R.A.	42	R.E.	35	R.A.	31	R.A.	31	R.A.	32
19	–	–	R.A.	35	–	–	–	–	R.A.	40	R.A.	37	R.A.	40	R.A.	37	–	–	R.A.	49	R.A.	39	R.A.	42	R.A.	49	R.A.	36	R.A.	41	R.A.	20	R.A.	23	R.A.	25
20	–	–	R.A.	32	–	–	–	–	R.A.	34	R.A.	34	R.A.	40	R.A.	37	–	–	R.A.	52	R.A.	39	R.A.	15	R.A.	49	R.A.	42	R.A.	41	R.A.	31	R.A.	31	R.A.	32
21	–	–	R.A.	47	–	–	–	–	–	–	R.A.	37	–	–	–	–	–	–	–	–	R.E.	36	R.A.	42	–	–	R.A.	36	R.A.	29	R.A.	37	–	–	–	–
22	–	–	R.A.	47	–	–	–	–	–	–	R.A.	34	–	–	–	–	–	–	–	–	–	–	R.A.	39	–	–	R.A.	48	R.A.	23	R.A.	25	–	–	–	–
23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	45	–	–	–	–	R.A.	35	R.A.	31	–	–	–	–
24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	59	R.A.	22	–	–	–	–
25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	47	R.A.	20	–	–	–	–
26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	41	R.A.	20	–	–	–	–
27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.E.	20	R.A.	20	–	–	–	–
28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	23	R.A.	25	–	–	–	–
29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	29	R.A.	37	–	–	–	–
30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	35	R.A.	25	–	–	–	–
31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	41	R.A.	20	–	–	–	–
32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	35	R.A.	31	–	–	–	–
33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	53	R.A.	22	–	–	–	–
34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	35	R.A.	31	–	–	–	–
35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	47	R.A.	20	–	–	–	–
36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	29	R.A.	43	–	–	–	–
37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	35	R.A.	31	–	–	–	–
38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	47	R.A.	25	–	–	–	–
39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	35	R.A.	37	–	–	–	–
40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	41	–	–	–	–	–	–
41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	29	–	–	–	–	–	–

G.—*continued.*

1849.				1850.				1851.				1852.				1853.						1854.								1855.									
June.		December.		June.		December.		June.		December.		June.		December.		April.		June.		December.		April.		August.		October.		December.		February.		April.		Augus		October.		December.	
Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.	Corps.	Months at R.M. Academy.
R.E.	27	R.E.	33	R.E.	39	R.E.	37	R.E.	43	R.U.	34	R.E.	43	R.A.	46	R.A.	56	R.E	49	R.E.	49	R.E.	53	R.E.	39	R.E.	35	R.E.	22	R.A.	30	R.A.	20	R.E.	11	R.A.	26	R.E.	22
R.A.	27	R.E.	33	R.E.	39	R.E.	41	R.E.	39	R.E.	49	R.E.	43	R.E.	49	R.A.	56	R.E.	43	R.E.	49	R.E.	53	R.E.	36	R.E.	41	R.E.	22	R.E.	36	R.E.	29	R.E.	23	R.A.	32	R.E.	33
R.A.	31	R.A.	44	R.E.	39	R.E.	37	R.A.	37	R.E.	45	R.E.	59	R.E.	46	–	–	R.A.	52	R.A.	43	R.A.	53	R.E.	41	R.E.	35	R.A.	28	R.E.	30	R.A.	15	R.E.	22	R.A.	32	R.E.	22
R.A.	31	R.A.	37	R.A.	35	R.A.	41	R.A.	39	R.E	37	R.E.	49	R.A.	55	–	–	R.E.	49	R.E.	49	R.A.	47	R.E.	45	R.A.	35	R.E.	28	R.E.	30	R.E.	20	R.E.	22	R.A.	27	R.A.	28
R.E.	27	R.A.	29	R.A.	35	R.A.	41	R.A.	43	R.A.	53	R.A.	55	R.E.	46	–	–	R.A.	43	R.A.	55	R.A.	41	R.E.	39	R.E.	41	R.A.	47	R.E.	24	R.E.	15	R.E.	16	R.A.	27	R.A.	27
R.A.	25	R.A.	33	R.A.	41	R.A.	45	R.A.	43	R.A.	47	R.A.	49	R.A.	55	–	–	R.E.	43	R.E.	43	R.A.	59	R.E.	45	R.E.	35	R.A.	28	R.E.	30	R.E.	26	R.E.	16	R.A.	37	R.A.	28
R.A.	31	R.A.	33	R.A.	39	R.A.	41	R.A.	37	R.A.	43	R.A.	59	R.A.	49	–	–	R.E.	55	R.E.	55	R.A.	59	R.E.	45	R.E.	35	R.A.	28	R.E.	30	R.E.	15	R.E.	17	R.A.	27	R.A.	27
R.A.	35	R.A.	44	R.A.	35	R.A.	43	R.A.	41	R.A.	53	R.A.	55	R.A.	49	–	–	R.E.	49	R.A.	49	R.A.	47	R.A.	45	R.E.	35	R.A.	27	R.E.	43	R.E.	21	R.A.	23	R.A.	37	R.A.	33
R.A.	38	R.A.	43	R.A.	39	R.A.	37	R.A.	43	R A.	43	R.A.	55	R.A.	43	–	–	R.A.	49	R.A.	55	R.A.	41	R.E.	38	R.A.	38	R.A.	35	R.E.	24	R.E.	26	R.A.	17	–	–	R.A.	33
R.A.	31	R.A.	33	R.A.	43	R.A.	37	R.A.	43	R.A.	49	R.A.	51	R.A.	61	–	–	R.A.	43	R.A.	55	R.A.	41	R.A.	63	R.A.	29	R.A.	30	R.E.	24	R.A.	26	R.A.	28	–	–	R.A.	33
R.A.	31	R.A.	33	R.A.	35	R.A.	41	R.A.	41	R.A.	43	R.A.	49	R.A.	61	–	–	R.A.	43	R.A.	55	R.A.	59	R.A.	45	R.A.	47	–	–	R.A.	30	R.A.	26	R.A.	28	–	–	–	–
R.A.	28	R.A.	33	R.A.	47	R.A.	43	R.A.	43	R.A.	45	R.A.	53	R.A.	55	–	–	R.A.	49	R.A.	61	R.A.	41	R.A.	45	R.A.	47	–	–	R.A.	36	R.A.	32	R.A.	33	–	–	–	–
R.A.	31	R.A.	33	R.A.	37	R.A.	43	R.A.	39	R.A.	43	R A.	59	R.A.	46	–	–	R.A.	67	R.A.	49	R.A.	47	R.A.	41	R.A.	35	–	–	R.A.	24	R.A.	38	R.A.	23	–	–	–	–
R.A.	38	R.A.	37	R.A.	47	R.A.	41	R.A.	39	R.A.	45	R.A.	59	R.A.	57	–	–	R.A.	55	R.A.	55	R.A.	41	R.A.	51	R.A.	47	–	–	R.A.	37	R.A.	26	R.A.	23	–	–	–	–
R.A.	38	R.A.	41	R.A.	61	R.A.	41	R.A.	53	R.A.	45	R.A.	51	R.A.	61	–	–	R.A.	61	R.A.	61	R.A.	53	R.A.	45	R.A.	47	–	–	R.A.	37	R.A.	39	R.A.	22	–	–	–	–
R.A.	27	R.A.	35	R.A.	35	R.A.	45	–	–	R.A.	55	R.A.	59	R.A.	55	–	–	–	–	R.A.	58	R.A.	59	R.A.	57	R.A.	47	–	–	R.A.	29	R.A.	21	R.A.	28	–	–	–	–
R.A.	25	R.A.	31	R.A.	39	R.A.	41	–	–	R.A.	47	R.A.	59	R.A.	49	–	–	–	–	R.A.	55	–	–	R.A.	45	R.A.	41	–	–	R.A.	37	R.A.	20	R.E.	23	–	–	–	–
R.A.	25	R.A.	37	R.A.	50	R.A.	47	–	–	R.A.	49	R.A.	59	R.A.	49	–	–	–	–	R.A.	55	–	–	R.A.	45	R.A.	41	–	–	R.A.	30	R.A.	31	R.A.	28	–	–	–	–
R.A.	29	R.A.	44	R.A.	47	R.A.	41	–	–	R.A.	43	R.A.	55	R.A.	61	–	–	–	–	–	–	–	–	R.A.	51	R.A.	47	–	–	R.A.	29	R.A.	26	–	–	–	–	–	–
R.A.	38	–	–	R.A.	43	R.A.	45	–	–	R.A.	43	–	–	R.A.	55	–	–	–	–	–	–	–	–	R.A.	57	R.A.	47	–	–	R.A.	29	R.A.	31	–	–	–	–	–	–
–	–	–	–	R.A.	37	–	–	–	–	R.A.	57	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	51	R.A.	41	–	–	R.A.	37	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	51	R.A.	41	–	–	R.A.	43	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	37	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R.A.	43

Question 33. Have any persons, or has any person, been hitherto entrusted with the duty of making representations as to existing defects or the possibility of improvements in the Academy? If so, to whom would such representations be addressed?

Question 34. Have any representations been made during the last fifteen years to the Lieut.-Governor by Officers or Professors, or by the Lieut.-Governor or others to the Master-General of the Ordnance, as to any insufficiency in the instruction afforded at the Academy? And if so, what have been the steps taken to inquire into such representations, and to remedy the defects pointed out, or make the improvements suggested?

MAJOR-GENERAL LEWIS, C.B., from R.E.

In reply to the questions, the Lieut.-Governor forwards a copy of the following letter:—

Royal Military Academy,
Woolwich, October 18, 1854.

SIR,

I BEG you to submit to the Lieut.-General of the Ordnance the inclosed from the Chaplain, and Officer commanding the Cadet Company, upon the subject of providing a chapel for Divine service, and covering the Gymnasium, so that the Cadets may play there in bad weather.

In my former reports, dated the 4th November 1851, and 8th June 1852, to the Master-General respecting the construction of a building on the premises for Divine service for the Cadets, and those immediately attached to them, with their families, I represented the wants of the establishment, and the expectation held out to the Chaplain on his appointment to the Academy, that a chapel should be built for him, since when, in 1847, he has laboured under the disadvantages of performing his duties in the dining-hall of the Cadets.

As regards the covering of the Gymnasium, I believe an offer was made of a design by Messrs. Fox and Henderson, the contractors, for a light iron roof last autumn, and that the scheme was abandoned, because the Master-General and Board were not prepared to submit the expenses to Parliament.

But neither this expense, or that of building a chapel, has ever been postponed because they were not deemed necessary; and Lord Hardinge, when Master-General, by his order of the 7th July 1852, regretted that the circumstances of the country, prevented a provision being made for building a chapel, and I take the liberty of transmitting a copy of my report of the 8th June 1854, which was laid before Lord Hardinge.

I beg to remark, in addition to these wants, that a work of great importance, authorized and provided for in the annual estimate of the current year, has not been commenced, viz., the construction of two class-rooms for drawing, for the use of the Cadets of the Theoretical Class, on the Common, although apparently decided by the Board's Order of the 4th August 1854. As the month of October has arrived, I have no expectation that the work will be executed this year; but I hope that there will be no impediment to the class-rooms being commenced as the season opens, for which the estimate provides 500*l.*

Although these expenses may appear heavy, they do not amount to the sum contemplated in 1847 to carry out the various propositions recommended by the Committee, of which Sir Thomas Hastings was President, in their report of 1846, which, in the printed estimates laid before Parliament for 1848–9, the following is an extract,—

"Woolwich District—Addition to the Royal Military Academy—Total estimate for the work, 20,000*l.*"

Of this I do not believe 7,000*l.* has been expended on new works since that period.

The services for new works for 1855–6, I take the liberty of recommending, are for the—

Academy Drawing-rooms, as provided in 1854–5 -	£ 862
New Chapel - - - - - -	1,800
Covering Gymnasium - - - -	2,000
	£4,662

which I hope may be submitted to Parliament.

I have, &c.

(Signed) G. G. LEWIS, Major-General, Lieut.-Governor.

J. H. Ash, Esq.

MAJOR-GENERAL W. D. JONES, from R.A.

REPLIES from MAJOR-GENERAL W. D. JONES, from R.A., formerly Inspector of Studies at the Royal Military Academy.

SIR, Bournemouth, Poole, Dorset, April 22, 1856.

IN transmitting my answers to the questions submitted to me by direction of the Commissioners appointed by the Secretary of State for War, to consider the best mode of re-organizing the system of training officers for the Scientific Corps, I beg to explain that I am not acquainted with the present system of education carried on at the Royal Military Academy at Woolwich, nor of the changes made since my connexion with that institution ceased in 1851, when fast declining health induced me to resign the appointment of Inspector; so that my remarks do not apply to anything that may have occurred since that date.

In reference to the latter part of your letter, stating that the Commission hopes that I will afford them my assistance by suggesting any measures that may seem to me calculated to render the existing education still more efficient, I would wish to make known an idea that has frequently come across my mind, viz., that it would be better, on making appointments to the Royal Military Academy, to make it clearly understood that it is not to be considered as a matter of course that every youth admitted, whatever may be his natural talents and capacity, whether great or small, dull or quick, should be equally deemed eligible for commissions in either of the two Ordnance Corps; but those only who have displayed intelligence and decided talent, with aptitude for study and self-improvement, should be advanced to the Practical Class, there to remain for two years, to complete their education in the higher branches of mathematics, and their application to the arts and sciences connected with the professional duties they are preparing for, and which are taught in that most useful class, so as to be well fitted for admittance into the scientific branches of the service; the remainder, if otherwise considered deserving, to receive commissions in other corps of the Army, where, as Regimental Officers, they would probably be acceptable acquisitions, and prove useful, good, and gallant soldiers, and well-educated gentlemen. This selection, at the end of the Theoretical Course, would entail no reflection on those not chosen for the Practical Class, as all men are not equally gifted, or alike blessed with aptitude for study. I consider that the two years spent in that most useful class, the Practical one, will not cause them to lose rank compared with those who obtain commissions from the Theoretical Class direct, if they enter the Ordnance corps with the rank of Lieutenant, as is the case now, and the others as Ensigns only.

A selection only from the Cadets of the Academy to receive commissions in the Scientific Corps, the rest if deserving in the Line.

I have, &c.

(Signed) WILLIAM D. JONES, Major-General.

A. H. Clough, Esq.,
Secretary to the Commissioners for Reporting on the
Education of the Scientific Corps.

The present staff of Professors and Masters might be made to suffice.

Question 30. Referring to the list of Officers, Professors, and Masters attached to the Academy, will you state whether you consider that there is or is not an insufficient amount of instruction afforded at the Academy? And will you particularize any branches of study which in your opinion should be added to or taken from the existing course?

Question 31. Is there, in your opinion, any deficiency in the staff of Professors and Masters at the Academy?

I can best answer this by taking the two questions as one. I consider that the number of Professors and Masters employed at the Academy is sufficient to impart a sufficient amount of instruction, provided all the youths, when admitted, are found really to possess a sound knowledge of the subjects required by the regulations; but a reference to the Admission Reports will show that very many are admitted with a very superficial knowledge of a great majority of the subjects required; so that the time of the Masters, for the first year, is occupied in imparting the very rudiments and elementary knowledge of the subjects they ought to have soundly known on joining, which leads to so many being removed at the probationary examination twelve months afterwards; and the valuable time of the Masters is thus occupied when they should have been engaged in carrying them forward in the course. This accounts for so many scarcely attaining, in the Theoretical Classes, any knowledge of the higher branches of pure and mixed mathematics. Probably a different arrangement and classification of the studies, and a rigid

MAJOR-GENERAL W. D. JONES, from R.A.

enforcement of the rule requiring a proper qualification on admission, would enable the present staff of Professors and Masters to impart a sufficient amount of instruction to every Cadet of fair abilities and diligence, to fit him for advance to the Practical Class in three years, instead of four, allowed by the regulations, or show him to be too dull or idle to give any hope of his becoming a superior scholar in any reasonable time. But arrangements would require to be made for carrying on the study of the higher subjects in mathematics in the Practical Class, as essential for the thorough understanding of the practical subjects brought to their notice in that valuable course of instruction. And thus the fourth year deducted from the time allowed in the Theoretical Course, might be more beneficially added to study in the Practical Class.

Interest has sometimes prevented the removal of Offenders.

Question 32. Have there been difficulties at any time in the removal of offenders, or in enforcing a sufficiently strict system of discipline at the Academy? If so, will you mention any occasions on which you have reason to believe that this has been the case, and will you state what you consider to have been the cause?

The power of removing offenders from the Royal Military Academy was vested solely in the Master General of the Ordnance, to whom the Lieutenant-Governor officially reported in detail every case of gross misconduct which he deemed a pernicious example to the rest of the Company, and subversive of discipline, giving his opinion thereon, generally accompanied by the minutes of a Court of Inquiry, composed of Officers of the Cadet Company, who had inquired into and sifted every circumstance connected with the affair. I have every reason to believe that when the Master-General, after due consideration of each case, deemed it necessary, he has firmly supported the Lieutenant-Governor, and the discipline of the Academy, by either directing the offender to be removed, or has awarded some severe punishment short of it, to be carried out at the Academy. I must, however, admit that many instances have occurred where the Master-General has afterwards, from the strong and repeated intercessions made by relatives for lenity, backed by powerful interest brought to bear upon him, been induced to give way, and allow the offender to return to the Academy, even when his offence remained as clearly established against him as at first, and no doubt had been thrown upon the fact. This must be admitted to have been a stumbling-block to those endeavouring to enforce a sufficiently strict system of discipline at the Academy. The most daring and insubordinate youths being frequently the most popular with their comrades, their return is hailed as a victory over the authorities at the Academy; and no one, whatever he may have done, ever seriously thinks his case hopeless as long as his friends continue to appeal, and importune the Master-General. A reference to the books in the Academy Office will show many such cases.

Question 33. Have any persons, or has any person, been hitherto intrusted with the duty of making representations as to existing defects, or the possibility of improvements in the Academy? If so, to whom would such representations be addressed?

I am not aware that any person has ever been intrusted with such duty.

Committee of Inquiry into the instruction afforded at the Academy.

Question 34. Have any representations been made during the last fifteen years to the Lieutenant-Governor by Officers or Professors, or by the Lieutenant-Governor or others to the Master-General of the Ordnance, as to any insufficiency in the instruction afforded at the Academy? And if so, what have been the steps taken to inquire into such representations, and to remedy the defects pointed out, or make the improvements suggested?

Nor am I aware that any specific representations have been made during the last fifteen years to the Lieutenant-Governor by Officers or Professors, or by the Lieutenant-Governors or others to the Master-General, as to any insufficiency in the instruction afforded at the Academy. But at the close of 1847, from what cause I am ignorant, the Master-General ordered a Committee of Inquiry, of which Sir Thomas Hastings, Surveyor-General of the Ordnance, was President, and the late Major-General Sir William Gossett, a Member, to assemble at the Royal Military Academy and make a thorough investigation into the organization of the institution, civil and military, and to inquire into the whole system and course of study carried on. By this

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Committee the greater part of the Officers, Professors, and Masters, were personally examined on their particular branches of instruction, in addition to which letters were sent by the Committee to a great number of Officers of the two Ordnance Corps and others, requesting their opinion on various points connected with the Academy, and as to some of the text books used in the instruction of the Cadets. To this Committee every office book and document was thrown open for inspection as required. On receiving a full report of their proceedings, the Master-General was pleased to direct such of their suggestions as he deemed beneficial and had approved, to be promulgated at the Academy, and immediately carried into effect; soon afterwards, the printed book of rules and regulations for the government of the Royal Military Academy, issued in 1840, was withdrawn, and another, as revised by Sir Thomas Hastings' Committee, dated 18th August 1848, substituted for it.

(Signed) WILLIAM D. JONES, Major-General.

April 22, 1856.

COLONEL PORTLOCK, R.E.

From COLONEL PORTLOCK, R.E., Inspector of Studies at the Royal Mliitary Academy, Woolwich.

Deficiencies in the Chatham course.

Question 4. What instruction or assistance in their professional studies is at present supplied to Officers in the Engineers, after joining their respective corps?

At Chatham, the Engineer Officers continue to study and practice surveying, and field works, mining, &c., so that for the time they are stationed there, it may be said, they are still under instruction. The time, however, has latterly been too short, and the scheme of instruction is far too limited, not embracing lectures on military tactics and science (viewed in a general light), nor affording that high order of instruction in civil engineering and architecture which seems absolutely necessary to prepare an Engineer for the various duties he has to perform. Professorships in these branches ought to be established.

Military tactics. Civil Engineering. Architecture.

To be corrected by the creation of Professorships.

Question 5. Would it be possible, and, if possible, desirable, to have further instruction or assistance given to Officers after joining? Of what nature should it be, and what would be the best means of affording it?

I think it both possible and desirable. Its nature should be such as I have pointed out already, and the means of affording it, most simply, appear to be by professorships, taking care that really able and experienced men should be appointed to them. The certificates of the professors would mark the peculiar talents of the Officers under instruction, and assist in distributing them to the services they were best fitted to perform.

Advanced courses of lectures at the Artillery Institution and Chatham would answer the purpose of a Senior Department.

Question 6. Does any institution for Officers in the Engineers, similar to the Senior Department at Sandhurst, appear to you to be desirable?

Not exactly of that character, as the Officers of Artillery and Engineers ought to enter their professions with so high a degree of acquirement as to put them in a position of advancing themselves in their professional studies, if disposed to do so. I think, however, that more advanced courses in Chemistry, Civil Engineering, and Architecture, Gunnery, and general Military Science and History, should be accessible to them, whenever quartered at Woolwich or at Chatham. Such courses should be instituted at the Artillery Institution, the professors being paid by the public, in connection with the Artillery service, and at Chatham for the Engineers, and a due record kept of the attention and progress of those attending the lectures.

Advancement must be held out as an incentive to study.

The great stimulus, however, must ever be the prospect of ultimate success in obtaining the object of labor, and until it shall be felt that acquisition of knowledge necessarily leads to a selection for employment in honourable and lucrative posts, it cannot be expected that any system of instruction should be fully successful.

Professional excellence the only legitimate object of the training to be given.

Question 7. Could any addition be advantageously made to the duties at present assigned to Officers in the Engineers, in time of peace, of a nature to continue and extend the scientific studies requisite for the

I cannot myself answer this question affirmatively, as, in a country like England, I think that every one ought to have the power of commanding position by industry and ability, and hence that a limitation of any one employment to per-

efficient performance of their duties in time of war?

sons professedly educated for another would be not only injudicious, but unjust. The real object is to adopt such a system of studies as shall render our Artillery Officers and our Engineer Officers the best and the most scientific in the world; not to train them for holding the posts of Under-Secretaries of State, Inspectors of Railways or of Roads, Chairmen or Deputy-Chairmen of Boards of Works, &c. Should such tuition excite in any of them a desire of further instruction, and they should rise above the ordinary level, and prove themselves fit for high employment, the Government would indeed be unwise not to avail itself of their services; but this ought only to be considered an exception, and not a rule. Were it otherwise, distinction in his own specific service would cease to be the object, and though more politicians and statesmen might be found in the two services, there would be fewer good Artillerists and Engineers. As regards the Engineers, the duties they already perform require that they should be able Civil Engineers and Architects, and there can be no doubt that their instruction in these branches is at present far too limited. In these remarks I refer merely to civil employments, not to military or Staff employments. In respect to staff appointments, they ought to be as freely open to Officers of Artillery and Engineers now, as they were to Officers of Engineers in the last century, when General Roy was successively Assistant-Adjutant-General, Deputy-Quarter-Master General, and Colonel of a Regiment, a course of promotion imitated afterwards in the cases of several other Engineer Officers. The training indeed of the Officers of Artillery and Engineers eminently fits them for the duties of such appointments.

Question 8. Do you consider that any re-adjustment of the functions assigned to the Artillery and to the Engineers would tend, without injury to the public service, to the improvement of their education as Officers? For instance, do you consider that such a question as that of the union of the two Corps of the Artillery and the Engineers can be entertained as a question of education?

This is a question which would be better decided by military men not connected with either Artillery or Engineers, as I fear the minds of the Officers of both services are too likely to be biased and warped by professional prejudices and vanity. In 1757 the British corps of Engineers was first formed as a body of *Commissioned* Officers, having previously existed as a corps of *Warrant* Officers only. Before that time the Artillery had performed some field duties now performed by the Engineers, but it was then thought expedient to transfer those duties to the latter corps. The connection, however, between the two services was for a long time very intimate, for not only were many Artillery Offices transferred to the newly-organized corps of Engineers, but for many years it appears that the Officers all joined the Artillery as Second Lieutenants, and were subsequently, after a sufficient service and training, removed to the corps of Engineers. Should the two Corps be united into one, much of the foolish jealousy which now, for the first time, exists between them, would undoubtedly be extinguished; but sooner or later it would be found again necessary to separate Officers performing Engineer duties from those performing Artillery duties, or the duties of neither the one service nor of the other would be well performed. As to the construction of batteries and magazines, evidence, not opinion, should decide the question; and that evidence would be required to prove, firstly, that the batteries and magazines of the French Artillery are more secure and better constructed than our own have been by the Engineers; and secondly, that our Artillery have not been less harassed, and more ready to perform their own especial duties than the French Artillery, by having been relieved after a hard day's cannonade from any other thought than that of attending to their guns.

Necessity of a separation between the corps.

Allotment of the construction of batteries &c., a question of evidence.

As regards pontoons, I have always thought and stated my opinion, that it would be best to attach them to the Artillery, as the horses necessary for their transport could be best supplied and managed by a body of men already trained for that especial service.

The pontoon trains should be attached to the Artillery.

Question 9. Do you think it would be more advantageous to the public service, that the Officers of the Artillery and of the Engineers should (after being selected as now deter-

If by the term "Practical Class," be implied a class in which no mathematical instruction should be given, I cannot think it desirable to send the candidates direct to it, as our experience up to the

Theoretical instruction not to be abandoned at the commencement of the State education.

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mined on, by means of a public competitive examination) proceed at once into what is termed a Practical Class, or be sent for one or two years to a Military College for instruction in the scientific studies, as well as in the modern languages, necessary for the proper performance of their duties? Or would you suggest any other plan?

present moment convinces me, that the instruction given in schools and colleges is conducted so loosely, as regards the power of applying knowledge, as to render it quite insufficient as a basis for practical or professional studies: see the Report of the mathematical examination by Professor Sylvester, of the first batch of candidates received, as a result of the public competitive examination, after three months study with us, and herewith also I send the examination of the batch recently joined; but I quite repudiate the term "Practical Class," as unphilosophical and mischievous, since the true practical class is really the Regiment of Artillery or the Corps of Engineers. The term "School of Application" is different and more sound, as it implies a system of instruction in which theory and practice go hand in hand together. Such ought always to be the case, and such it has always been my aim to effect. On such a system, then, those branches of mathematics would be taught which it is necessary a scientific Officer should know, whilst their application would be kept before the student at every step of his progress. My own opinion still continues unchanged, that two years at least ought to be devoted to such tuition in a Military College, or "School of Application."

"School of Application" a better term than "Practical Class."

The course to last two years.

Question 30. Referring to the list of Officers, Professors, and Masters, attached to the Royal Military Academy, will you state whether you consider that there is or is not an insufficient amount of instruction afforded at the Academy? And will you particularize any branches of study which, in your opinion, should be added to or taken from the existing course?

The list of Officers, Professors, and Masters is in the hands of the Commissioners. Considering the ages at which the Cadets at present enter the Academy, it would be impossible to dispense with the history and geography, more especially now that the recent public examinations at King's College and Burlington House have shown how imperfectly those subjects are taught at the ordinary educational establishments of the country. No other subject is taught which could be dispensed with, or which is not intimately connected with a professional education. Sometimes I have wished to introduce Latin, but the manifest impossibility of finding time for it has forced me to abandon any such attempt, and to content myself with what is now taught, and with endeavouring, as much as possible, to improve the mode of teaching.

When, however, a new organization shall have been completed, the following changes ought to be made:—

Elementary history and geography to be abandoned.

Teaching Elementary History and Geography should be abandoned.

Military history to be added.

Lectures on Military History, involving a consideration of the physical features of countries, as bearing on the movements of armies, and incidentally discussing the political and social relations of the countries concerned, should be adopted. The effect of this instruction should be tested by written themes or essays, as well as by *vivâ voce* examination.

German to cease to be obligatory.

At present, German and French are both obligatory, which I think an injudicious arrangement, as it implies a readiness in acquiring foreign languages which is so rarely possessed by Englishmen. I think French ought to be obligatory on all, and those only who possess a talent for languages encouraged to go on with German. Every one ought to be able to acquire a correct knowledge of the French language, and a tolerable facility in expressing himself in it; whereas, by a division of his attention between two languages, he fails perhaps in acquiring a sound knowledge of either. The great advantage of obtaining marks in the German would be a sufficient encouragement for those possessed of ability in that direction to study the language.

Architectural and Machine drawing to be added.

To the Drawing branch there ought to be added Architectural and Machine Drawing; these embrace perhaps all which could be undertaken with Mathematics and Fortification, and the present practical studies, as regular studies; but there ought to be provision made for occasional courses on collateral studies, such as Photography, Electro-Magnetism, &c. See reply to next question.

Question 31. Is there, in your opinion, any deficiency in the staff of Professors and Masters at the Academy?

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I consider the present staff of Professors and Masters ample for what is now taught, but I think not so for what ought to be taught. Nor do I quite like the mode in which they are made to teach some of the subjects.

Readjustment of the duties of the Professors, and consequent increase of salaries required.

For example: for the lectures on Natural Philosophy, forty in number, the sum of eighty guineas per annum has been allowed,—a sum quite insufficient to command the services of a first-rate man; and hence the Professor has usually delivered them in addition to his other duties. Such a system is radically bad, as it reduces the salary for Lecturers into a perquisite, and leads, as a necessary consequence, to hastily prepared and inefficient lectures. I think the Lecturer, on a new system, should be paid efficiently, should be selected from the most able men, be expected to prepare a proper course of lectures, and to devote the whole of an attendance to them, namely, an hour in the lecture-room, and the other hour or more in the study-room, explaining difficulties, and guiding the student in his record of what he has heard.

In a similar manner, one of the Mathematical Masters is Instructor in History and Geography; and I need only add to what I have said, that I greatly dislike the system of allowing any one Master to hold two offices, as there must always be the temptation of preparing the work for one course in the time properly devoted to another. Every Master ought to be fully paid for the duties of one office, but not be paid by the salaries of accumulated duties. In a new system there should of course be a special Professorship of Military History regulated on the same principles as those proposed for the Professorship of Natural Philosophy.

New Professorships.

The Professorship of Astronomy and Optics, now merged in the Professorship of Practical Mechanics, should again be revived as a distinct Professorship. Masters in Modelling, Machine, and Architectural Drawing, would also be required; and at Chatham there should be established a Professorship of Civil Engineering and one of Architecture, the lectures and instructions of which should be attended by all Engineer officers for a definite period; and be free to others when subsequently stationed at Chatham and disposed to improve themselves.

As I have before said, also, I think a sum of money should be at the disposal of the Inspector (or Director) of Studies, for occasional lectures on Photography, or other such subjects. From the want of this, it has never been possible to have a course of such lectures; for, though the Board of Ordnance liberally granted the money necessary for procuring a superior Photographic Apparatus, they would not allow the cost of a series of lectures upon the best modes of using it. A new system will necessarily lead to a re-adjustment of hours, and then the peculiar tastes and powers of the Cadets may be more attended to in their instruction, some studies being considered indispensable for all, and some others left voluntary, or adopted where it is supposed that the Cadets will be capable of profiting by them.

Question 32. Have there been difficulties at any time in the removal of offenders, or in enforcing a sufficiently strict system of discipline at the Academy? If so, will you mention any occasions on which you have reason to believe that this has been the case, and will you state what you consider to have been the cause?

Difficulties in the removal of Cadets, to what attributable.

Difficulties have frequently occurred in the removal of offenders, but I am not disposed to affirm that, in consequence, there have been difficulties in enforcing a sufficiently strict system of discipline at the Academy. Difficulties of removal occur simply because the power of removal rests with the highest authority of the Academy, now the Secretary for War, formerly the Master-General of the Ordnance; and because, as a very natural result, this highest authority has not always agreed with the Lieut.-Governor in considering the offence of a Cadet sufficiently serious to justify his removal. Since my connexion with the Academy, I have known cases in which the Captain commanding the Cadet Company has urged upon the Lieut.-Governor the propriety, in his view, of removing Cadets, and in which the Lieut.-Governor has not agreed with him; and in like manner, other cases in which the Lieut.-Governor has thought removal necessary, and the supreme head has not

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agreed with him. Now, I have no doubt the Captain of the Cadet Company considered his powers of enforcing discipline affected by the Lieut.-Governor's refusal, just as much as the Lieut.-Governor thought his affected by that of the Master-General. I do not on this point agree with either, as it appears to me most desirable, that this ultimate and severe remedy should be only applied by an authority external to the Academy itself, and therefore uninflu enced by any local feelings; and if so, it would be absurd to suppose that it should always be applied as recommended, without any exercise of judgment on the part of the higher authority.

The power of removal should continue to rest with the Secretary of State.

Everyone is disposed, and very naturally so, to attribute any failure in maintaining discipline or ensuring respect, to the want of a power of punishment in his own hands; thus, the Chaplain doubtless imagines that respect for him, and attention to his wishes, would be increased by possessing the power of arrest, and the Masters of the Academy the same; but this is an error, though a common one, as the exercise of such power, under the influence of momentary irritation, would more frequently produce hatred than respect. In the study rooms, the Masters report, and the Inspector, who is free from any personal feeling on the subject, punishes, and thus all fear of hasty and capricious punishment is avoided, while at the same time the authority of the Master is fully supported. The Inspector's authority of punishment is limited to a certain point, when it is necessary that he should appeal to the Lieut.-Governor, and though I have not always, perhaps, found the Lieut.-Governor agree with me as to the amount of punishment, I am satisfied that nothing has occurred to lessen my efficiency in maintaining order in the class-rooms. The same reasoning applies throughout, and it would be most irrational to explain any defects of discipline, if such can be charged against the Academy, to the want of absolute power in the Lieut.-Governor.

Discipline of the Academy; age of the Cadets unsuited to a military system.

The difficulties of the Academy are really due to the ages of the Cadets, and the unfitness of a purely Military system for managing them. Boys of fourteen, fifteen, and sixteen require much personal supervision in order to form their characters, which young Officers, very often appointed without any sufficient knowledge of their tempers and habits, cannot be expected to bestow. Such Officers may, indeed, be able to superintend drill, but not moral training. Rarely do they draw the Cadets towards them, and become their advisers; more frequently repel them by a harsh dictatorial manner, the Cadet being in their eyes a soldier. There has been also, during all the time I have known the Academy, great inconsistency in treating the Cadets: honour is constantly talked of, and yet doubts as to their truthfulness are not unfrequently expressed. I have heard even the lie given in very rough and emphatic terms. Confidence is professedly placed, and yet offences are found out in a way that shows that no real confidence had existed; hence a contest arises between the Officer and Cadet, and the latter becomes tricky and disingenuous. In nothing is this more visible than in the attempts to stop smoking; and in respect to this habit which the Cadets see or know that their parents, as well as some of their friends, indulge in, I cannot but suggest that the Officer would do well to set an example of self-denial, and he would then be able to say to the Cadets, "I know that smoking would be insufferable in your rooms, and though I have myself smoked, I have determined to abandon it so long as I continue your Officer, as an encouragement to you to do the same." My own views of the discipline of the Academy will doubtless be considered chimerical by many; but, assuming that the minimum age hereafter will not be below sixteen, I would organize a Court of Honour amongst the Cadets, and all offences against truth or decency should be submitted to its inquiry and judgment, the ultimate punishment continuing as now with the Officer. By such an arrangement, I am satisfied that a higher tone of principle would be generated, whilst the danger of severe, and sometimes prejudicial punishments, the consequence (in great schools) of the monitorial system, would be avoided.

Court of Honour.

Academy Journal.

I would also institute an Academy Journal, under the editorship of the Inspector, by means of which the Cadets would be taught to weigh the merits of actions, and to express their feelings upon them. I was thought in jest when I once hinted at such a project as this, though, when a Cadet, I tried the experiment successfully, saw its good effects, and could have carried it on had I been possessed of the means of lithographing the copies, and not been obliged to write them out myself.

Question 33. Have any persons, or has any person, been hitherto intrusted with the duty of making representations as to existing defects, or the possibility of improvements in the Academy? If so, to whom would such representations be addressed?

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According to the strict interpretation of the regulations, no person or persons have been intrusted with the duty of making representations as to existing defects, or the possibility of making improvements in the Academy. In respect to studies, the duty of the Inspector, as defined by the regulations, is "to see that the course of instruction is carried on in strict conformity to the rules and regulations, and is not to permit any change whatever to be made in them without a written order from the Lieut.-Governor, fully detailing the alterations, which order he is to communicate to the persons concerned." The same regulations give to the Lieut.-Governor the general charge and superintendence of the whole institution, and state that "he is to see that every branch, both of academical and military instruction, is conducted according to the 'rules and regulations;' and again, he is desired to make arrangements for supplying the deficiency, in case of the absence of a master, and further, to inforce such a degree of uniformity in the mode of conveying instruction as shall steadily advance the students in the practical and professional objects of their education;" so that the Lieut.-Governor is expected to perform the duties of Director of Studies, and the Inspector becomes in some degree his duplicate. In this respect there is theoretically a marked, and in my opinion a very disadvantageous, difference between the constitution of the office of Inspector of the Academy and of that of Director of Studies in the French schools, as in the latter case, the Director is not only required to watch over the progress of studies, but to report upon them, and to suggest periodically the required modifications. In the French schools, in fact, the object of instruction is clearly marked out, but the books and details are considered to be variable according to circumstances; whereas, in our system, everything is reduced to a rigid fixture which can only be disturbed by repeated efforts requiring the coincidence of opinion, first, of the Inspector, secondly, of the Lieut.-Governor, and thirdly, of the Master-General or Secretary of State.

Duties of the Inspector of Studies;

and of the Lieut.-Governor.

Difficulty in modifying the details of the studies.

Such is the theory of the system in practice. The Inspector does occasionally attempt to modify existing arrangements. For example, encouraged by the Lieut.-Governor, I stated freely my opinion on some parts of the system as soon as I had fully studied it, but it was considered by the higher authorities, that it would be unwise to act upon my objections till I had been longer at the Academy. Since then, I have succeeded in quietly modifying the system, so as, in my opinion, to improve it materially in several branches; as, for instance, the instruction in chemistry has ceased to be a course of lectures only, and has been extended to a progressive course of theoretical and practical instruction—marks being now allowed for it, both in the theoretical and practical classes. The fortification course, also, has been made to assume more decidedly the character of teaching principles, rather than systems; theme writing has been introduced into the history and geography teaching. Additional masters have been appointed for languages, so as to give greater power of teaching, &c.; but, notwithstanding a certain amount of decided advance, I feel that the difficulty of carrying out minor changes, from the division of power and responsibility, is an evil which ought to be remedied in any future re-organization of the office of Inspector.

Improvements which have been gradually introduced.

In respect to the office of Inspector itself, a few remarks may not be ill-timed, as many mistakes exist respecting it.

1st. It is highly important as regards discipline, all punishments being regulated on a uniform system, and not left to the sudden impulses of persons necessarily varying from each other in temper and judgment.

Value of, and qualifications for, the office of Inspector of Studies.

2nd. It ensures not only attention on the part of the student, but also on the part of the masters. In my time as a Cadet at the Academy the duty was very loosely performed, and in consequence, several of the masters (men, too, possessing a high moral and religious character) were more occupied in writing and preparing for the press their own private works, than in teaching the classes. This discreditable practice has, I trust, entirely ceased, as everyone knows that whilst in the class-room he is bound to give all his time and his attention to his duties; let me add, that the duties of Inspector have now been long fulfilled conscientiously, and that the office is no longer a sinecure.

3rd. It serves as a regulator in producing harmony in the whole system of instruction, without in any way clogging the movements of any one part; as

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the Inspector looks at the machine as a whole, and is able, therefore, to detect sources of obstruction which would pass unnoticed by instructors looking only to their own operations.

4th. Some have spoken of the office as if it required a man superior to every branch of study—an Admirable Crichton; but this is a fallacy, as it requires only a man of high character, of gentlemanly address, of conciliatory yet firm temper, a fair reputation (both in the profession and out of it) as a man of science; and surely there ought never to be a difficulty in finding such a man, either in the Artillery or in the Engineers. If men are appointed without such qualifications, it is only because personal considerations, not the interest of the service, have determined the selection.

Question 34. Have any representations been made during the last fifteen years to the Lieut.-Governor by officers or professors, or by the Lieut.-Governor or others to the Master-General of the Ordnance, as to any insufficiency in the instruction afforded at the Academy? And if so, what have been the steps taken to inquire into such representations, and to remedy the defects pointed out, or make the improvements suggested?

I am not aware, personally of any such representations having been made, and I should remind the Commissioners that the whole system of the Academy, as regards both its military and instructional branches, was inquired into by a Committee in 1848, eight years only having expired since the study and discipline of the Academy were by that Committee regulated. (See the regulations of that date in the hands of the Commissioners). A copy of the system of study of 1792, which I enclose, will be interesting for comparison with the regulations of 1848. As I have before stated, my representations to the Lieut.-Governor of the necessity of additional language masters were acted upon by him, and carried out by the Master-General and Board, by the appointment of two assistant-masters for each language taught, namely, German and French. In like manner, my recommendation respecting an alteration in the chemical instruction were also attended to and carried into effect. In the drawing branch, also, my representations respecting the inadequacy of the class-rooms for an efficient course of teaching were favourably received both by Lord Raglan and by Mr. Monsell; but the building of new class-rooms having been unfortunately made to depend partly on a saving in another service, which saving was not realized, this most essential work has not yet been carried into effect. I regret this more, as I had myself requested several eminent men to visit our schools, and to give me their opinion respecting them; and I consider it the branch which most requires reform and extension, not including, at present, architectural or machine drawing.

Minor changes, such as alterations in the books or mode of teaching, must be always attended with difficulty whilst it is necessary to command the assent of so many persons.

(Signed) J. E. Portlock, Colonel.

Memorandum.

The Regulations give only the full course considered desirable as the ultimate result of instruction, accompanied by a provision that the Lieutenant-Governor may, from time to time, cut off any portion of the course so as to adjust it to circumstances; so that in time of war the Officers have always been sent out with much lower scientific qualifications than in time of peace.

The Regulations allow four years as the extreme period of residence, a limit which was doubtless arranged in reference to the *whole* prescribed course, and which ought therefore to be diminished in proportion as the required extent of course has been diminished. This adjustment, however, of the time of residence to the extent of course not having been provided for in the Regulations many have doubtless passed through, when the demand for Officers has been great, who never could have qualified for commissions under normal circumstances.

Latterly, however, many have been removed from the lower rooms on account of bad examinations and loss of places, on the ground that they could not have been expected to qualify satisfactorily. One in the second, and four in the third room were thus removed after the last examination, a clause in the Regulations sanctioning such removals.

Colonel Portlock, R.E.

These remarks answer indirectly the questions, and I will now answer them directly.

The Regulations do not define the minimum, but it is settled every session on the authority of the Lieutenant-Governor (now Governor), after consulting with the Professors if necessary. When I came here the minimum in pure mathematics did not include spherical trigonometry nor the differential calculus, and in mixed mathematics only statics. It was gradually raised, and will now include every thing in pure mathematics up to the early portion of the differential calculus, whilst in mixed mathematics it has for several sessions included status, dynamics, and hydrostatics.

Every cadet must obtain decimal five of the minimum course before he can be returned qualified for removal to the practical class; the absolute minimum therefore is fixed, but not, as I have before observed, the relative minimum in respect to the time of residence; hence it has often happened that cadets of two, three, and four years have qualified at the same time upon the same minimum.

It is right, however to observe that of late more rigid rules have been adopted in respect to *bad* examinations, cadets who have obtained very low decimals having been put back to a lower class, and in a second failure been recommended for removal.

I am, &c.
J. E. Portlock,
Colonel, R. E.

September 9, 1856.

Course of Study as established in 1792.

A distinct Account of the Course of Studies which a Gentleman Cadet is to go through, before he is reported fit for a Public Examination for a Commission in the Royal Corps of Artillery and Engineers.

Royal Military Academy, Woolwich, July 8, 1792.

1.—Fortification and Artillery.

Fortification.

1. The definitions and explanations of the works of both Regular and Irregular Fortification, correctly written and understood.
2. The construction of the First, Second, and Third Systems of M. de Vauban, described on paper.
3. The same of M. Coehorn's System.
4. The same of M. de Cormontaigne's System.
5. Irregular Fortifications described on paper.
6. The Attack and Defence of fortified Places.
7. The Art of Mining.
8. The Elements of Field Fortification.
9. How to trace on the ground Permanent and Field Fortification, with and without mathematical instruments.
10. To take plans, with and without instruments.
11. The theory and practice of Levelling.
12. How to estimate the Works of a Fortification, viz.:—revetements, ramparts, ditches, batardeaux, powder-magazines, turned arches, and groined arches.
13. To produce a fair copy of the book containing the calculations, plans, and sections relative to the estimates.
14. To produce a complete course of the above, neatly drawn, of the plans, with their sections and geometrical elevations, composed of sixty-eight plates.
15. To produce the Field Book, containing the practice on the ground, the tracing out works of Permanent and Field Fortification, Surveying and Levelling.

Printed and manuscript books made use of in the above course:—

The Course of Fortification, from Mr. Landmann, comprised in sixty-eight plates.
The Estimates, from Mr. Landmann's manuscript.
Surveying, and Tracing out Works on the Ground, from Mr. Landmann, in manuscript.
The Attack and Defence of fortified Places, by Mr. Müller.
Pleydell's Field Fortification.

COLONEL PORTLOCK, R.E.

Artillery.

1. The definitions and explanations of the several parts of Artillery; also the tables containing the general dimensions and constructions of guns and mortars, correctly written and understood.

2. The general construction of brass and iron guns, sea and land mortars, and howitzers, described on paper.

3. The general construction of ship and garrison carriages, travelling carriages, land and sea mortar-beds, described as above.

4. The same of the iron work for ship, garrison, and travelling carriages.

5. The different kinds of wood made use of for the several sorts of gun-carriages and mortar-beds.

6. How to find the weight of guns, mortars, and howitzers.

7. To find the quantity of powder which a chamber contains.

8. To find the diameters of shot and bores of guns.

9. To find the weight of shot and shells.

10. To find the number of shot and shells contained in a pile.

11. To ascertain the number of horses necessary to draw the different natures.

12. The number of men required to construct a battery in one night.

13. To produce a complete course of the above neatly drawn, containing the planes, sections, and geometrical elevations, composed of fifty-seven plates.

Printed and manuscript books made use of in the above course:—

The Course of Artillery, from Mr. Landmann, comprised in fifty-seven plates;

The Construction of Artillery, from Major Blomfield, Inspector of the Royal Artillery;

Müller's Artillery.

2.—MATHEMATICS.

Arithmetic—in all its parts.

Logarithms—their nature, use, and construction.

Geometry—the theory from Euclid's Elements, four first books.

Algebra—from the first elements to the solution of cubic and higher equations.

Trigonometry—with heights and distances.

Mensuration—in superficies and solids, in theory and practice, with surveying and measuring of artificers' works, buildings, timber, &c.

Fluxions—with their various applications.

Conic Sections.

Mechanics—including motions, equable and variable; forces, constant, variable, and percussive; gravity, sound, and distances; inclined planes; projectiles; practical gunnery; pendulums; centres of gravity, percussion, oscillation, and gyration, ballistic pendulum, &c.

Hydrostatics and Hydraulics—including the pressure, motion, and issuing of fluids; the filling and exhausting of vessels, &c.; specific gravities of bodies; syphons, pumps, diving bells, &c.

Pneumatics—including the nature, properties, and effects of the air and the atmosphere, with the air-pumps, syringes, condensing engine, thermometer, and barometer, with the method of measuring altitudes by the barometer and thermometer.

Practical Exercises—concerning these and various other branches, as the weight and dimensions, and piling of shot and shells; bulk or capacities of various vessels or figures, to contain certain weights of powder; distances, by the motion of sound; concerning the effects of variable and constant forces, &c.

Resistance of Fluids, as water, air, &c.—with their action on bodies in motion, &c.

Gunnery—Robins's new principles of Gunnery; experiments, particularly with the ballistic pendulum.

Printed and manuscript books made use of in the above course of Mathematics:—

Books—Dr. Hutton's Arithmetic:

Logarithms;

Mensuration;

Conic Sections and Select Exercises (Tracts);

Mr. Robins's Gunnery, the first volume of his Works;

Euclid's Elements, by Professor Simpson, of Glasgow;

Rossignol's Geometry;
Bonnycastle's Algebra;
Application of Algebra to Geometry, from Simpson's Algebra.

Manuscripts—Dr. Hutton's Fluxions;
Mechanics;
Hydrostatics;
Pneumatics;

The above course of Mathematics is correctly written down by the Gentlemen Cadets in their books, with drawings applicable to the several parts of it.

3.—DRAWING

With the Second Drawing Master:—

Figure Drawing.—The several parts of human figures, from drawings by the Master.

Perspective.—In theory and practice:—

1. Theory of Perspective;
2. Putting Planes in Perspective;
3. Elevations;
4. Measures and proportions of Figures at different distances;
5. Light and Shadow—(this from the Jesuits' Perspective).

With the First Drawing Master:—

With Mr. P. Sanby—Putting Perspective in practice by copying from drawings, which qualifies them for drawing from nature, teaches them the effect of light and shade, and makes them acquainted also with aërial perspective.

Then to proceed to take views about Woolwich and other places, which teaches them at the same time to break ground, and forms the eye to the knowledge of it.

4.—THE FRENCH LANGUAGE.

Grammar and Pronunciation thoroughly learned, and the practical application of it.

Translation from English into French, and from French into English, and the translation written down and made correct.

Exercises—Particular exercises to be given them to perform in the language, chiefly on subjects that have a Military tendency.

5.—CHEMISTRY.

The Gentlemen Cadets generally attend two and often three courses of lectures in Chemistry, the theory and practice of it. They make notes during the lectures, which are thirty-two in number; these they enter fair into books which are given them for that purpose, and which are most copious on the heads relative to Artillery; as Gunpowder, the materials that compose it; the Metals, &c.

The Gentlemen Cadets are also taught Fencing and Dancing, the exercise of Small Arms and the light Field Pieces.

(Signed) BENJAMIN STEHELEN, Lieut. Governor,
Royal Military Academy.

Lieutenant Phipps,
Inspector, Royal Military Academy.

PERIODICAL AND OTHER EXAMINATIONS EXCLUSIVE OF ENTRANCE EXAMINATION.

Royal Military Academy, May 9, 1856.

Board of Examiners distinct from the Instructors.

I HAVE always been of opinion that the Examiners should be a distinct body from the Instructors, as it is evident that the tone of the examination papers will naturally be consistent with the tone of instruction, and hence the results of examination be no fitting test of the character of the instruction and ability of the Instructors, though they may show the amount of attention paid by the student to the instruction. I think, then, that there ought to be a Corps of Examiners, as in the French schools, and that a Board of Examination should be formed, consisting of them and the Inspector, who should be chairman. The papers should be prepared by the several Examiners, submitted, as now.

Colonel Portlock, R.E.

to conduct Probationary, Periodical, and Commission Examinations.

to the Inspector, and then brought before the Board and approved. The results of the examinations should be embodied in the Inspector's report, forwarded to the Lieut.-Governor, and by him submitted to the Minister of War for his approval and decision. Probationary, periodical, and commission examinations should be conducted by this Board, the Inspector calling together, however, only those members required for the specific examination, as it is evident that all would not be required for every examination; the Instructors in Practical Artillery, for example, not being required for the earlier examinations, and some of the other Examiners not being required for the commission examination.

I here recommend, it will be observed, an independent action, so far as the instruction is concerned, for the Inspector or Director of Studies; and such, I think, it ought to be in order to attain the utmost improvement. The duty of Lieut.-Governor should be that of preserving a balance between the instructional and military branches, and seeing that every one does his duty; anything else leads to a division of responsibility, and a paralysis of action.

(Signed) J. E. Portlock, Colonel,
Inspector.

RETURNS furnished by Col. Portlock, R.E., relating to the Progress of the Cadets recently admitted, after Competitive Examinations, at the Royal Military Academy, Woolwich.

A.

LIST of the CADETS who joined after the First Public Competitive Examination, held at King's College, August 1855.

No.	——	Date of Appointment.	Age when appointed.	Order gained at Examination in March 1856.	Remarks.
		1855.	Y. M.		
1	R.E.	30 Aug.	17 3	1	
2	- - -	„	18 10	...	Discharged 7th April 1856, at the request of his friends.
3	R.E.	„	18 6	4	
4	R.E.	„	18 10	8	
5	- - -	„	17 10	19	
6	- - -	„	17 3	18	
7	R.E.	„	19 0	5	
8	R.E.	„	17 6	3	
9	- - -	„	18 9	12	
10	R.E.	„	18 5	6	
11	- - -	„	17 8	21	
12	R.E.	„	18 10	7	
13	R.E.	„	17 9	2	
14	- - -	„	18 5	10	
15	- - -	„	18 8	17	
16	- - -	„	17 9	11	
17	- - -	„	19 0	9	
18	- - -	„	17 9	13	
19	- - -	„	17 7	25	Not commissioned, having failed to qualify in Mathematics. To be re-examined in June.
20	- - -	„	17 1	24	
21	- - -	„	18 4	15	
22	- - -	„	17 3	28	
23	- - -	„	17 3	27	
24	- - -	„	17 6	26	Not commissioned, having failed to qualify in Mathematics. To be re-examined in June.
25	- - -	3 Sept.	19 1	14	
26	- - -	30 Aug.	17 2	22	Not commissioned, having failed to qualify in Mathematics. To be re-examined in June.
27	- - -	„	18 7	23	
28	- - -	„	18 7	29	Not commissioned, having failed to qualify in Practical Artillery. To be re-examined in June.
29	- - -	„	18 7	20	
30	- - -	„	17 6	16	Not commissioned, having failed to qualify in Mathematics. To be re-examined in June.
31	- - -	10 Sept.	18 3	...	Removed by order of Lord Panmure, 2d November 1855.

N.B.—Those marked R.E. were promoted to the Royal Engineers, and the remainder, exclusive of those accounted for in the column of Remarks, were promoted to the Royal Artillery.

May 7, 1856.

J. E. PORTLOCK, Col., Inspector.

AA.—SECOND DIVISION.—Periodical Examination Return of the Practical Class of Mathematics under the Fourth and Seventh Masters.

Royal Military Academy, December 1855.

Order of Appointment.	Order according to Credits gained in Mathematics.	Order gained at Examination in March 1856.	Age when appointed.	Credits which should be gained.	Credits gained.	Extra Credits gained.	Total Credits gained.	Extent of Progress.	Result of Examination. Unsatisfactory or Satisfactory.
			Y. M.						
1	3	1	17 3	4,850	3,140	400	3,540	Vol. 1. Integral Calculus. Vol. 3. Rigid Dynamics.	Very satisfactory.
2	28		18 10	3,250	1,125	...	1,125	„ Mensuration. „ Projectiles.	Unsatisfactory.
3	4	4	18 6	4,850	2,969	425	3,394	„ Integral Calculus. „ Rigid Dynamics.	Very satisfactory.
4	6	8	18 10	4,200	2,987	220	3,207	„ Differential Calculus. „ Impact.	Very satisfactory.
5	21	19	17 10	3,250	1,622	...	1,622	„ Mensuration. „ Ditto.	Moderate.
6	16	18	17 3	3,500	1,866	...	1,866	„ Spherical Trigonometry. „ Ditto.	Moderate.
7	10	5	19 0	4,200	2,656	...	2,656	„ Differential Calculus. „ Ditto.	Satisfactory.
8	8	3	17 6	4,200	2,675	130	2,805	„ Ditto. „ Ditto.	Satisfactory.
9	19	12	18 9	3,250	1,691	...	1,691	„ Mensuration. „ Projectiles.	Moderate.
10	1	6	18 5	4,200	3,650	190	3,840	„ Differential Calculus. „ Impact.	Very satisfactory.
11	20	21	17 8	3,500	1,638	...	1,638	„ Easy Differentiation. „ Ditto.	Moderate.
12	5	7	18 10	4,850	2,813	400	3,213	„ Integral Calculus. „ Motion on a Curve.	Very satisfactory.
13	2	2	17 9	4,850	3,335	215	3,550	„ Ditto. „ D'Alembert's Principle.	Very satisfactory.
14	7	10	18 5	4,850	3,027	100	3,127	„ Ditto. „ Pendulum, &c.	Very satisfactory.
15	25	17	18 8	3,250	1,443	...	1,443	„ Mensuration. „ Projectiles.	Very moderate.
16	11	11	17 9	3,500	2,370	...	2,370	„ Easy Differentiation. „ Impact.	Satisfactory.
17	12	9	19 0	4,850	2,066	220	2,286	„ Integral Calculus. „ Ditto.	Satisfactory.
18	22	13	17 9	3,500	1,521	...	1,521	„ Spherical Trigonometry. „ Ditto.	Moderate.
19	26	25	17 7	3,250	1,266	...	1,266	„ Mensuration. „ Projectiles.	Unsatisfactory.
20	15	24	17 1	4,200	1,730	140	1,870	„ Differential Calculus. „ Impact.	Moderate.
21	14	15	18 4	4,500	2,013	...	2,013	„ Integral Calculus. „ Ditto.	Satisfactory.
22	18	28	17 3	3,500	1,791	...	1,791	„ Spherical Trigonometry. „ Ditto.	Moderate.
23	24	27	17 3	4,200	1,474	...	1,474	„ Differential Calculus. „ Ditto.	Very moderate.
24	30	26	17 6	3,250	885	...	885	„ Mensuration. „ Projectiles.	Very unsatisfactory.
25	9	14	19 1	4,850	2,650	60	2,710	„ Integral Calculus. „ Motion on a Curve.	Satisfactory.
26	27	22	17 2	3,250	1,133	...	1,133	„ Mensuration. „ Projectiles.	Unsatisfactory.
27	17	23	18 7	4,200	1,785	20	1,805	„ Differential Calculus. „ Impact.	Moderate.
28	23	29	18 7	4,200	1,480	...	1,480	„ Ditto. „ Ditto.	Very moderate.
29	13	20	18 7	3,500	2,248	...	2,248	„ Spherical Trigonometry. „ Ditto.	Satisfactory.
30	29	16	17 6	3,250	1,121	...	1,121	„ Mensuration. „ Projectiles.	Unsatisfactory.

March 19, 1856.

J. E. PORTLOCK, Royal Military Academy.

B.

List of the Cadets who joined after the Second Public Competitive Examination held at Burlington House, in January 1856.

No.	Date of Appointment.	Age when appointed.		
		Years.	Months.	
	1856.			
1	8th March.	18	10	
2	do.	18	8	
3	do.	19	3	
4	do.	18	8	
5	do.	19	11	
6	do.	17	11	
7	do.	19	10	
8	do.	19	7	
9	do.	19	10	
10	do.	18	2	
11	do.	18	5	
12	do.	18	7	
13	do.	18	3	

May 7, 1856.

J. E. Portlock, Col., Inspector, R.M.A.

BB. MATHEMATICS.

STATEMENT of Proficiency of Cadets directly appointed to the Practical Class of the Royal Military Academy Woolwich, in joining the Class in April 1856.

Subjects of Examination.

	Euclid, Six Books.		Algebra.		Plane Trigonometry.		Mensuration.		Spherical Trigonometry.		Elementary Statics.		Elementary Dynamics.		Co-ordinate Geometry.		Differential Calculus.		Integral Calculus.	Hydrostatics.	Geometry of Planes.
No. of Questions.	9		11		6		3		8		10		9		7		9				
Full Marks.	54		33		18		9		24		30		72		21		27				
No. of Cadet.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.	Marks gained.	Character of Examination.			
1	47	S.	14	Mod.	10	Mod.	6	Mod.	9	Mod.	14	Mod.	11	Mod.	‡		9	Mod.			
2	54	V.S.	21	S.	13	S	8	S.	‡		*		‡		‡		‡		‡	‡	
3	51	V.S.	9	Unsat.	9	Mod.	5	Mod.			10	Unsat.	‡		‡		‡		‡	‡	
4	(Not yet joined the Class.)																				
5	(Not yet joined the Class.)																				
6	51	V.S.	29	V.S.	16	V.S.	8	S.	18	S.	26	V.S.	20	S.	17	S.	16	Mod.			
7	31	Mod.	15	Mod.	16	V.S.					9	Unsat.							‡		
8	42	S.	6	V.Uns.	11	Mod.	6	Mod.			14	Mod.									
9	41	S.	3	V.Uns.	5	Unsat.	6	Mod.			8	Unsat.			‡				‡		‡
10	36	Mod.	11	Unsat.	8	Mod.	7	S.	‡		9	Unsat.	‡		‡				‡	‡	
11	38	Mod.	14	Mod.	8	Mod.	4	Unsat.	‡		*		‡				‡		‡	‡	
12	50	V.S.	18	Mod.	4	Unsat.	8	S.	‡		19	S.	15	Mod.					‡	‡	
13	45	S.	20	S.	11	S.	8	S.	‡		25	V.S.	19	S.	14	S.			‡		

* Declined Examination.
The space left blank shows that examination in the subject has been deferred till greater proficiency is attained in more elementary subjects.

‡ Shows that the Cadet has not studied the subject with any degree of care, if at all.

F. W. VINTER.
STEPHEN FENWICK.

From Captain Shakespear, R.A., Second Captain Commanding Cadet Company, and Paymaster at the Royal Military Academy, Woolwich.

Captain Shakespear, R.A.

Sir, Royal Military Academy, April 14, 1856.

In acknowledging the receipt of your letter dated Metz, 11th March 1856, I have the honour to offer a few observations in answer to to the question which was inclosed, and I beg to say that I am not aware of any difficulty having taken place since the period I assumed the command (early in July 1854) in the removal of offenders from this institution; but discipline was much affected in two instances I may mention, where two young gentlemen were removed for bullying, one in July 1854 and the other in February 1855. Both these gentlemen having obtained commissions in the Line very shortly after their removal, and which led the Cadets to conceive most erroneous ideas, "that it required only to be removed to get a commission without further trouble." I am aware that this was openly spoken of amongst them, and it led to much irregularity last year; however, since the time I have mentioned, others have been removed, and have, I believe, failed in obtaining commissions. The result has been favourable to the Academy in the matter of discipline.

Matters affecting discipline at the Academy.

Discipline is further affected by the continued attempts made by the friends of those removed for misconduct in endeavouring to get a Cadet reinstated; this may be very natural, but is detrimental to good behaviour amongst the Cadets generally. Upon this subject I would suggest that when after due and careful consideration before a Court of Inquiry, or otherwise, it is considered necessary for the well-being of the Institution to remove a Cadet for misconduct, that the friends should be made acquainted and that he should then be removed, that this step should be final, and a report made to the Commander-in-Chief for any future reference.

I would add here that I am very averse to the punishment of removal if it can possibly be avoided. I have seen in some instances the good effect of rustication, though this entails much expense on the friends, but not so great as in removal.

Punishments.

Rustication preferred to removal.

The Corporals are not sufficiently attentive in the performance of their duties, nor do they hold their rank in much estimation; this is caused by a Corporal, after reduction for misconduct, being allowed to join the Practical Class before an opportunity is given of seeing whether there is improvement in his duties. It would, I consider, have a good effect, if it was understood that no Corporal could be moved to the Practical Class after reduction for misconduct, unless a report in his favour can be made by his Commanding Officer, so as to reinstate him as Corporal, and a reasonable time allowed to ascertain whether he is more attentive and steady in his general conduct. I know that some Corporals who have little consideration for themselves prefer reduction to escape duty, while others would not be Corporals at all if they could avoid it.

Corporals who have been reduced not to join the Practical Class, without a report in their favour.

There are punishments inflicted which are detrimental to a sound state of discipline, and on which I request to offer a few words. The regulation of punishing Corporals and Cadets for "bad returns," at the close of each month is one; and long confinement to the inclosure is another. Although the first-mentioned is in consequence of inattention or idleness in study, yet the Commanding Officer is responsible that the punishment is carried out.

Punishments for "bad returns," detrimental to discipline.

There are generally from twenty-five to forty Cadets punished for "bad returns" on the last day of the month. I have constantly remarked the evil effects of this system of dealing with the young gentlemen; it is a kind of worrying punishment, which may not take place for several days after the irregularity or idleness has happened; the moral effect is consequently lost; so many being punished together, and turning out to extra drill together begets carelessness amongst them. It is well known in the military branch that the general conduct is affected by these monthly returns, and I believe the punishment does not carry much weight with it.

The object of punishing young lads ought to be well considered: it can do much good, and at the same time can do harm if no moral effect is produced.

Regarding long periods of confinement to inclosure, they are detrimental to discipline. Cadets get tired with several days extra drill and confinement, and one evil of such punishment is, that before it is over, a Cadet may again be in

Long confinements.

CAPTAIN SHAKESPEAR, R.A.

arrest or confinement for some other irregularity in or out of study, and this makes him careless, when he perhaps finds himself undergoing two or three punishments at the same time.

I would suggest that the punishments should always be short, prompt, and decisive, and given immediately after the irregularity has been committed (excepting cases requiring a Court of Inquiry or a special report), and that they should consist of the same kind as at present in force; but for idleness in study, task work should be added to a short punishment, and that there be no punishments at the end of a month for "bad or indifferent returns."

Position and designation of the Officer commanding.

It will not I trust be out of the way to mention the position of the Officer commanding. He is a First Captain of Artillery, and is styled "Second Captain commanding Cadet Company." I would suggest that he should be styled "Officer commanding Gentlemen Cadets, Royal Military Academy;" and that the title of "Cadet Company" should cease; that the title be "Gentlemen Cadets, Royal Military Academy." It may be thought I have alluded unnecessarily to this, but discipline is undoubtedly affected by the position and powers of the Commanding Officer; he has at present no power to place a Cadet in solitary confinement as his own punishment. I have often felt the evil effects of the want of this power, when insubordination or impertinence has taken place out of study, where the best result would have happened had the Commanding Officer had, on the spot, the power of placing the offender for a few hours in solitary confinement.

Examinations not to be held, except at the regular periods.

I have further been led to consider that the discipline of the Academy has been affected by the custom of some time past of giving commissions and having examinations for the Practical Class at intermediate times, instead of the regular periods in summer and winter before each vacation. I do not think the Ordnance Corps gain by this system; it does harm to study as well as to discipline.

There are other subjects that would be be beneficial to discipline if carried out, viz., the want of a chapel has been very much felt for years past, there being no place for Divine worship except the dining-hall. I think discipline would improve were there a proper building for religious worship.

A roof for the gymnasium, and a larger workshop for all the Cadets; also a place covered in at the west end, where the Cadets garden is, for gun-drill, &c., in wet weather, would be of much service to the institution.

I may say that whatever can be added for the benefit and comfort of Cadets is sure to be beneficial to discipline, because it gives them employment, and therefore tends to make them happy and contented. A little money should not be grudged for so desirable an end.

With reference to the other subjects contained in your letter, I advocate keeping up this establishment as a college for scientific study and knowledge, as also for training young gentlemen to be good useful Officers. I know of none adapted to such purposes but Sandhurst and this place, where young gentlemen can study previously to entering the Army. I consider that much improvement would be gained towards young men being efficient and useful Officers, if the age for admission was sixteen years, and that eighteen years old should be the age for obtaining a commission, and that the examination should be by competition for entrance amongst the sons of gentlemen. They will be of a better age for learning military obedience and discipline.

Age of admission and receiving commission.

I would suggest that this should be a practical college, and that more opportunities should be given for study in languages, practical artillery, and gunnery, chemistry, the different kinds of military drill, as also riding for all Cadets, and attending lectures in the veterinary art, and the management of horses.

The opportunities which Officers of Artillery have to continue their scientific knowledge for the discharge of their duties during their course of service depend very much upon where they are stationed. In some stations companies are attached to field batteries, in others they are in a fortress, or where there are heavy guns, and in some stations a company is alone, with no means of keeping up a practical knowledge of the profession. At head quarters there are several companies, but it has been generally admitted that companies learn more at out-stations; this has been in consequence of so much time having been taken up with garrison duties.

Companies learn more at out-stations.

I think it very desirable that an Artillery Officer should be prepared for any kind of military duty.

Trusting that it may not be considered that I have taken up time by entering into useless subjects, and considering that what I have brought forward would be for the welfare of this institution, and for the service,

I have, &c.

(Signed) G. B. Shakespear, Captain, R.A.,
Commanding Cadet Company.

A. H. Clough, Esq.

Captain Shakespear, R.A.

From J. J. Sylvester, Esq., M.A., F.R.S., Professor of Mathematics at the Royal Military Academy.

Professor Sylvester.

In obedience to the request contained in the above letter I beg to submit the following suggestions :—

1. That the age of admission should be considerably raised. My experience in the Academy has left me under the painful impression that the Cadets are just beginning to take an interest in their studies and to comprehend their scope, when they are about to quit them, too often never to be resumed.

Age of admission to be raised.

2. I consider that admissions into the Academy should be by open competitive examination exclusively.

Admission to be by Competitive examination.

The beneficial effect of such a system would be much enhanced by reserving some substantial advantages to a certain number of such of the candidates for admission as should pass the best examination. Two or three of them for instance might be admitted at each entrance, on the same terms of subscription as are now in force in favour of the sons of widows of military men. The spirit of emulation might also be kept alive by holding out the inducement of analogous advantages, in the shape of increased pay to a limited number of those who might pass the best examinations during their course of study and on quitting the Academy. Publicity should be given to the lists containing the order of merit for each examination, as is the case with the examinations at the Universities. Furthermore, if the expedient should not be deemed too harsh in its operation, the energies of the Cadets might be still further stimulated, and the necessity for strenuous exertion made to be more keenly felt by causing the annual admissions to exceed by a slight per-centage the expected number of vacancies, so that success in the final examination for commissions should come to be regarded as a reward and not as a right. It would, of course, be in the power of the authorities to mitigate the disappointment of the unsuccessful candidates, by providing them with commissions in the Line, provided that their comparative failure should have been the result of inferior ability, and not of want of industry, and that their conduct had been in all respects unexceptionable.

Additional incentives to competition.

3. I think it of importance that the body of instructors, or their chiefs, should have a more direct action on the studies of the Academy ; they might form a faculty of professors analogous to the Conseil d'Instruction at the Ecole Polytechnique, to be presided over by the Lieut.-Governor, and whose duty it should be, amongst other things, subject to his sanction, to choose and vary the text books, to consider any proposed amendments in the plan of instruction, to originate improvements, to notice anything objectionable in the mode of teaching, and in general to fulfil the functions of an Educational Committee sitting "en permanence." I may here observe that I consider the use of a stereotyped "Course of Mathematics" very objectionable, and that it would be far better to adopt an eclectic method, which should leave open the choice of the best text books as they might appear from time to time on each subject, and that the professors and masters should not enjoy the monopoly of writing such text books for the use of the academy. The present system is one of almost complete *isolation*, both as regards the communication of the professors and masters among themselves, or their joint action upon the studies of the institution. I may instance in my own case, that although at the head of the *corps* of instruction, I am never aware when, where, or to whom the prizes which are subject to my recommendation are actually awarded. In like manner, when illicit practices at a periodical examination which I conducted were brought under the notice of the Lieut.-Governor, I was never consulted as to the punishment to be meted out, nor even made acquainted therewith at the time, except by general report.

Advantages of a Council of Instruction.

Choice of text-books to be left open.

PROFESSOR SYLVESTER.

4. I think it would be desirable to introduce a break into the present long sittings at mathematical study, which extend over three continuous hours in the morning, and two and a-half hours in the afternoon of the same days. I do not consider it possible that the attention of young men can be kept concentrated, for such long periods without intermission, on a single abstract subject.

Functions of Professor and Master to be distinguished.

5. I submit that there should be a distinction in function as well as name between the office of Professor and Master. My idea of the Professor is that he should stand forth as animating and controlling the working of the entire system, rather than he should, as now, give his energies and time to the business of carrying out the detail of instruction in one particular class-room. His chief work, I conceive, should be lecturing; he would thus be in a position to supply continually to the general body of Cadets a fund of scientific principles. These would be afterwards made the groundwork of instruction in the several class-rooms, and be enlarged upon and followed out to their consequences under the superintendence of the instructors, who would thus come to represent the répétiteurs of the Ecole Polytechnique, or the private tutors of our Universities, It would also devolve on the Professor to hold repeated examinations, and to ascertain by every means in his power that the instruction under him was being effectually carried out.

Mathematical attainments at present insufficient.

Question 30. Referring to the list of officers, Professors, and Masters attached to the Academy, will you state whether you consider that there is or is not an insufficient amount of instruction afforded at the Academy? And will you particularize any branches of study which in your opinion should be added to or taken from the existing course?

The amount of instruction, so far as relates to the quantity of time set apart for it, and the labours of the Professors and Masters in seeking to impart knowledge, is, in my opinion, not insufficient; but if the question refers to the attainments of the Cadets on leaving the academy, these, in my opinion, and so far as relates to my own department, are insufficient, meagre, and unsatisfactory.

I am not prepared to say that any new branches of study could with advantage be added to the existing course, but there should be, in my opinion, a much greater development of some of the branches already professedly taught. The commissioners are doubtless aware that the published mathematical course is not to be accepted as furnishing the measure of the amount of mathematical instruction actually conveyed, as the knowledge of only a very limited selection of articles from it is insisted upon as a qualification for joining the Practical Class.

The published course more extensive than what is actually taught.

Neither am I of opinion that any branch of study at present included in the course could be advantageously taken from it; but I venture to raise the question whether some portion of the time (three whole mornings and afternoons in each week) at present devoted to the details of drawing and fortification, might not (if the Cadets came up to the Academy better prepared,) be advantageously appropriated to studies of a less technical character.

A new system of instruction will necessitate modifications in the Staff.

Question 31. Is there, in your opinion, any deficiency in the staff of Professors and Masters at the Academy?

If the existing system of instruction, in its general features, is to be perpetuated, there is not, so far as opportunities have been afforded me of forming an opinion, any deficiency "in the staff of Professors and Masters;" but if the system of the Ecole Polytechnique, and other Continental military schools, is to serve as a model for the Academy in its re-organized condition, it can scarcely be questioned that considerable modifications in the staff may become necessary.

(Signed) J. J. SYLVESTER,
Professor of Mathematics at the Royal Military Academy.

April 24, 1856.

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APPENDIX TO REPORT

OF

THE COMMISSIONERS

APPOINTED TO CONSIDER

THE BEST MODE OF RE-ORGANIZING THE SYSTEM

FOR

TRAINING OFFICERS FOR THE SCIENTIFIC CORPS.

Ordered to be printed 20th March 1857.

(57. [Commons 0. 53]

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APPENDIX.

APPENDIX A.

Decree concerning the Re-organization of the Polytechnic School.

Saint Cloud, November 1, 1852.

The Prince President of the French Republic, considering the law of the 25th Frimaire of the year VIII. of the Republic (December 16, 1799), relative to the Organization of the Polytechnic School; the Decrees of 27th Messidor, year XII., and of 22nd Fructidor, year XIII. (July 16th, 1804, and September 9th, 1805); considering, likewise, the law of April 14th, 1832, on Promotions in the Army; the laws of January 26th, May 3rd, and June 5th, 1850; as well as the Report drawn up by the Mixed Commission appointed in accordance with that law to revise the Programme of Admission to the Polytechnic School, together with the Programmes of Instruction in the said School, in order to bring them into harmony with the conditions required by the public service; upon the proposal made by the Minister of War; Decrees:—

Title I.—*The Institution of the Polytechnic School.*

Art. I. The Polytechnic School is especially intended to form pupils for the following services:—

1. The Artillery, military and naval.
2. The Engineers, military and naval.
3. The Navy, and the Hydrographical Department.
4. Civil Engineers, for Roads, Bridges, and Mines.
5. The Staff Corps.
6. The Manufactures of Powder and Saltpetre.
7. The Telegraphs.
8. The Tobacco Department.
9. Any other public service requiring an extensive knowledge of Mathematics, Physics, or Chemistry.

Art. II. No pupil can be admitted to any one of the above services unless he has passed the examinations on leaving the School, and is considered admissible by the jury appointed by Article 60. A pupil, however, does not by fulfilling these conditions obtain any right to admission to one of the services: his appointment will depend on the number of places vacant at the time he leaves the School, and on the place he then occupies in the classification by order of merit, as specified in Article 66.

Art. III. The Polytechnic School is dependent upon the Department of the Minister of War.

Art. IV. Every year the Minister of War fixes the number of pupils to be admitted. This number may be one-tenth larger than the number of places, which it is calculated can be given in the public services at the time of the pupil's departure from the School.

Art. V. The instruction given to the pupils shall include the course of studies described in Art. 21.

Art. VI. The charge for board and education (*pension*) is 1,000 francs (40*l.*); the charge for the outfit (*trousseau*) is fixed yearly by the Minister of War. Annual payments.

Art. VII. Exhibitions or half-exhibitions (*bourses ou demi-bourses*) are granted to such students as have previously proved that their families are unable to support them at the School. Bourses and demi-bourses.

The inability of the family and of the young man himself must be established at the time when his name is put upon the list of competition, by a deliberate vote of the Municipal Council of his town, approved by the Prefect of the Department.

The Boards of Instruction and Administration for the School (appointed by Articles 35 and 71) meet under the presidency of the Commandant of the School to consider the applications; and upon their recommendation the exhibitions and half-exhibitions are granted by the Minister of War.

The reasons for the gift are published yearly in the "Moniteur Universel," and in one of the local papers of the department in which the exhibitioner (*boursier*) and his family reside.

Upon the recommendation of the same Boards, a whole or a half outfit may be granted to each exhibitioner or half-exhibitioner when he enters the School,

APPENDIX A.

TITLE II.—*Mode and Conditions of Admission.*

Admission annually by competition.

Art. VIII No one can be admitted to the Polytechnic School except by competition.

The competition is open to the public, and annual.

The rules are laid down by the Minister of War, after advising with the Board of Improvement (*Conseil de Perfectionnement*) appointed by Art. 38.

Art. IX. The Examiners for Admission are appointed by the Minister of War for a period of three years, after which they may be re-appointed. Upon his request, whenever a new examiner is to be appointed, the Board of Improvement is to confer with the Board of Instruction (Art 34), and to send in the names of two Candidates.

These persons must take no part in the preparatory instruction of the Candidates for admission.

Art. X. No one is admitted to the examinations for admission to the Polytechnic School without having proved—

1. That he is a Frenchman, born or naturalized;
2. That he has been vaccinated, or had the small pox;
3. That he is more than sixteen, and not more than twenty years of age on the 1st of January in the year of the competition.

Age of admission.

But non-commissioned officers as well as private soldiers in the Army may come up for the competition, provided, at the time of their examination they are above twenty and not more than twenty-five years of age, and can prove actual service in their regiments for a period of two years.

To obtain leave to compete, the above military candidates must produce certificates from the Councils of Administration in their corps, stating the length of their service, and attesting their good conduct.

No dispensation, either with regard to age or to time of service, can be allowed.

Military candidates admitted to the examinations above the age of twenty cannot, upon leaving the School, be appointed to any but a military service.

Art. XI. Every year the Minister of War, after advising with the Board of Improvement draws up a programme of the subjects on which the examination is to bear, and determines the time of its opening.

This order is published before the 1st of April.

Art. XII. At the close of the examination, a jury consisting—

1. Of the Commandant of the School,
2. The Second in Command,
3. The Director of Studies,
4. The Examiners for Admission,
5. Three members of the Board of Improvement, selected by the Board for that purpose,

draws up, by order of merit, the list of successful candidates. This jury proceeds according to the forms prescribed, upon the advice of the Board of Improvement, by the Minister of War.

Two-thirds of its members are required to form a quorum.

Art. XIII. The Minister of War, following the order of the list drawn up by the jury, admits to the School, within the limits stated in Art. 4, such of the successful candidates as fulfil the conditions stated in Art. 10.

Art. XIV. No one can be admitted to the School who by reason of any bodily malformation or infirmity is likely to be unable to follow the course of studies, or unfit to enter the public service.

Art. XV. A certain number of foreigners may be admitted to attend the lectures of the School, but none of them can be admitted as boarding pupils.

TITLE III. *Section* I.—*Staff* (Personnel) *of the School.*

Government of the school.

Art. XVI. The Governing Body (*personnel du commandement*) is composed of—

1. A General Officer, as Commandant;
2. A Colonel or Lieutenant-Colonel, as Second in Command;
3. Six Captains, as Inspectors of Studies;
4. Six Adjutants.

Art. XVII. The Commandant of the School and the Second in Command are named by the Executive (*chef de l'Etat*) upon the proposal of the Minister of War.

The Second in Command is chosen among the former pupils of the School, and in those corps of the army which it supplies with officers.

The Captains and Adjutants are appointed by the Minister of War. The Captains are taken from the old pupils of the school in the army. The Adjutants are taken from the non-commissioned officers in the army, and especially from those who are recommended for the rank of Sub-lieutenant.

Art. XVIII. The authority of the Commandant of the School extends to every branch of its management and over the whole staff, whether military, educational, or administrative. He is especially charged with seeing that all the regulations are observed, and with the maintenance of order and discipline. He presides in the Boards of Improvement, Instruction, and Administration, and in the Committees appointed by Art. 36,

whenever he chooses to be present. He is under the immediate orders of the Minister of War. He is not allowed an aide-de-camp.

Art. XIX. The Second in Command exercises, under the direction of the Commandant, a daily superintendence over the order and discipline of the establishment.

He is a member of all the Councils.

In case of the absence or illness of the Commandant, the Second in Command takes his place in all his functions, except as Chairman of the Board of Improvement.

Art. XX. The functions of the Captains and Adjutants are fixed by the Internal Regulations of the School, as drawn up by the Minister of War.

Section II.—*Educational Staff.*

Art. XXI. The Educational Staff consists of—

A Director of Studies,
Two Professors of Mathematical Analysis,
Two Professors of Mechanics and Machinery,
One Professor of Descriptive Geometry,
Two Professors of Natural Philosophy,
Two Professors of Chemistry,
One Professor of Geodesy and Astronomy,
One Professor of Architecture and Public Works,
One Professor of Military Science and Fortification, chosen from the Officers of the Scientific Corps (*armes spéciales*),
One Professor of French Composition and Literature,
One Professor of German,
One Professor of Figure and Landscape Drawing,
One Principal Master of Scientific Drawing (*chef des travaux graphiques*) in Descriptive Geometry, Topography, and Fortification.
Two Assistant Teachers (*Répétiteurs*) of Mathematical Analysis,
Two " of Mechanics and Machinery,
One " of Descriptive Geometry,
Two " of Natural Philosophy,
Two " of Chemistry,
One " of Geodesy and Astronomy,
One " of Architecture and Public Works,
One " of Military Science and Fortification, chosen from the Officers of the Scientific Corps (*armes spéciales*),
One " of French Composition and Literature,
One " of German,
One Master of Machinery Drawing,
Three Masters of Figure and Landscape Drawing.

Five Examiners :—

One for Mathematical Analysis,
One for Mechanics and Machinery,
One for Descriptive Geometry, Geodesy, and Astronomy,
One for Natural Philosophy,
One for Chemistry.

Besides the above, an Assistant Teacher (*Répétiteur*) may be added for any course in which it is thought desirable, by the special direction of the Board of Improvement. The whole number of these extra Assistant Teachers must not exceed four.

Director of studies.

Art. XXII. The Director of Studies is appointed by the Executive upon the proposal of the Minister of War, and is chosen from two candidates presented by the Board of Improvement.

Art. XXIII. The Examiners of the Students and the Professors are nominated by the Executive upon the proposal of the Minister of War.

The Principal Master of Scientific Drawing is appointed by the Minister of War.

The Assistant Teachers, Extra Assistant Teachers, and Masters are appointed annually by the Minister.

Upon his request, the Board of Improvement is bound, whenever it becomes requisite to fill up a vacancy in any one of the appointments named in three preceding paragraphs, to present two candidates, after advising with the Board of Instruction, in accordance with the third paragraph of the 34th Article.

Art. XXIV. The Director of Studies has the special superintendence of all educational details. His duty consists in securing, under the authority of the Commandant, the execution of the programmes of instruction and all regulations relating to the studies.

The whole body of Instructors, the Examiners of Students and the Examiners for Admission, are all alike placed under his direction.

He is a member of every Board in the School, and, in the Board of Improvement, has the office of Secretary.

Art. XXV. The Examiners of the Students are intrusted with the examinations upon

APPENDIX A.

which at the end of each school year, the classified lists are drawn up, for passing from the lower to the upper division, and for admission into the public service.

In the course of the year they are expected to keep themselves acquainted with the state of instruction in the School, and more particularly in those subjects in which they will have to examine. They are to enter any observations or proposals, which they have to make for improvements in these branches of the instruction, in reports to be presented to the Director of Studies, and by him submitted to the Board of Improvement.

Section III.—*Administrative Staff.*

Administration of the School.

Art. XXVI. The School has attached to it,—
A General Manager (*administrateur*),
A Librarian,
A Treasurer, Keeper of the Archives,
A Storekeeper,
Three Keepers of the Scientific Collections.

The Minister of War nominates to these offices; upon his request, the Board of Administration established by the 71st Article presents two candidates, whenever it is requisite to appoint to one of the above offices, after having previously consulted the Board of Instruction, as prescribed by the 3rd paragraph of the 34th Article.

The Treasurer and the Storekeeper are responsible for their trusts, and are bound to furnish security.

Art. XXVII. After taking the opinion of the Board of Administration, the Minister of War fixes the number and duties of the administrative officers and their subordinates.

He appoints, upon the proposal of the Commandant of the School, all such officials as will be allowed to partake in the benefits granted by the laws relative to pensions and annuities.

The Commandant nominates to the other subordinate offices. The salary attached to each of them is fixed by the Minister of War, upon the proposal of the Board of Administration.

Section IV.—*Medical Service.*

Art. XX III. The Medical Service consists of—
One Superior Surgeon (*médecin major*),*
One Assistant Surgeon (*médecin aide major*).

Section V.—*General dispositions concerning the various Functionaries of the School.*

Pay of Military and Civil Officers.

Art. XXIX. The officers and non-commissioned officers who are in active service, and employed within the School, receive from the War Department the pay belonging to their grade, according to the general regulations.

The Adjutants, when it is found requisite, are paid upon the budget of the School a supplementary allowance, sufficient to complete the salary awarded by the tariff annexed to the present decree.

The non-military functionaries and assistants are paid upon the budget, conformably with the terms of the same tariff.

Art. XXX. The salary of all non-military functionaries belonging to the School are subject to certain deductions, determined by the Ordinance of May 26, 1832.

All the above officers are entitled to pensions, which are told down to them in accordance with the regulations of their respective services.

The subordinate officials appointed by the Commandant are entitled to no pension, and consequently are subject to no abatement of salary.

Art. XXXI. The functionaries of the School, those attached to the Instruction included, can only be dismissed by the authority who appointed them.

Title IV.—*Instruction.*

Length of course.

Art. XXII. The course of studies at the Polytechnic School lasts for a period of two years.

No pupil can be allowed to pass a third year at the School except by an order of the Minister of War, granted upon the suggestion of the jury to whom is entrusted (Art. 60) the classification of the division to which the student belongs. Such permissions can never be granted but in the case of an illness, which has interrupted the pupil's studies, and thus incapacitated him to satisfy the requirements of the examination at the close of the first or second year.

No student can be allowed to pass more than three years at the School.

Except in the case laid down in the last paragraph of the 50th Article, a student who has ceased to be a member of the School may be re-admitted, but only by the usual course of competition, and in case of his still fulfilling the conditions of admission to that competition.

* The grades in the medical department of the French army are three, *médecins principaux*, *médecins majors*, *médecins aides-majors*, each subdivided into a 1st class and a 2d class.

Art. XXXIII. The pupils form two divisions, 1st, those who have been newly admitted; 2nd, those who have gone through the first year of studies.

Council of Instruction.

Art. XXXIV. A Board or Council of Instruction gives its opinion on questions referred to its consideration, relating to the instruction in the School and the studies of the pupils.

At least once a-year, when called upon to meet for that purpose, it lays before the Board of Improvement its views, relative to such ameliorations as it may be deemed advisable to introduce into the course of studies, into the programmes of admission and of instruction in the school, and generally, relative to all measures that may contribute to the progress of the Students.

It must also be consulted whenever the Board of Improvement is charged with the presentation of candidates for the stations of Examiners of the Students, Examiners for Admission, Professors, Assistant Teachers (*Répétiteurs*), and Masters. It is likewise consulted whenever the Board of Administration has to present candidates for the offices of Librarian and Keeper of the Scientific Collections.

In both cases the Board of Instruction takes the first step in making the proposal, suggesting in all practicable cases two candidates; the Board of Improvement and the Board of Administration, after advising upon the proposal, proceed to a determination.

The Board of Instruction attends through its delegates at the deliberations of the Boards of Improvement, Administration, and Discipline. Its meetings take place when it is deemed necessary, upon the summons of the Commandant of the School.

Art. XXXV. The Board of Instruction consists of—

The Commandant of the School, Chairman,
The Second in Command,
The Director of the Studies,
The Examiners of the Students,
The Professors.

Two Captains, Inspectors of Studies, are appointed yearly by the Commandant of the School to act as secretary and assistant secretary to the Board, and are empowered to vote.

Whenever the Board discusses questions relative to the admission of pupils into the School, the Examiners for Admission sit with the other members and vote.

Professorial Committees.

Art. XXXVI. The Professors are distributed into three Committees, forming the ordinary councils for the direction of the studies, as regards the details of instruction.

Each Committee meets as often as is necessary, at the request and under the presidency of the Director of Studies. But, whenever the Commandant of the School thinks fit to attend the deliberations of a Committee, he takes the chair.

Two Committees cannot deliberate together, unless it be upon the summons and under the presidency of the Governor.

The three Committees united constitute the Board of Instruction, to which every member of that council must be summoned.

The Examiners of the Students, Examiners for Admission, the Principal Master of Scientific Drawing, the Assistant Teachers (*Répétiteurs*), and Masters, may be called upon, according to circumstances, to take part in the business of the Committee whose duty it is to consider those branches in which they are respectively employed.

Council of Improvement.

Art. XXXVII. A Board of Improvement is charged with the supreme direction of the studies at the School, and with the introduction of such improvements as the public service may require. It disposes the whole course of teaching so as to agree with that followed at the Schools of Application, draws up the programmes for admission and instruction at the School, and regulates the distribution of time among the pupils. The Board submits its proposed measures to the Minister, to whom it reports yearly concerning the instruction and general success of the School. It meets every year after the examinations; and on other occasions, whenever the Minister of War deems it necessary.

Art. XXXVIII. The Board of Improvement consists of—

The Commandant of the School, Chairman,
The Second in Commmand,
The Director of Studies,
Two Delegates from the Department of Public Works,
One „ of the Naval Department (*la Marine*),
One „ of the Home Department (*l'Interieur*),
Three „ of the War Department,
Two „ of the Academy of Sciences,
Two Examiners of Students,
Three Professors at the School.

The Delegates of the Ministerial Departments are appointed by their respective Ministers.

The Academy of Sciences nominates for its Delegates such of its members as are more particularly conversant with the mathematical, mechanical, physical, and chemical sciences.*

The Board of Instruction selects the Examiners of Students and the Professors.*

* See however the modifications introduced by the decree of December 26th, 1852, below, page 11.

APPENDIX A.

The removable members of the Board of Improvement are nominated for one single year; but they may be re-appointed.

The Minister of War appoints a member of the Board of Improvement to act as Chairman in case of the absence of the Commandant.

The Director of the Studies acts as Secretary to the Board.

Art. XXXIX. In order to make a quorum, and to deliberate, at least one member more than the half of the whole number must be present at the Board of Instruction and at the Board of Improvement. In case of an equal division, the Chairman has a casting vote.

Art. XL. Whenever the Board of Improvement has to present any candidates (Art. 9, 22, and 23), the votes are taken by ballot. There can be no presentation, unless the candidate obtains at least one more than the half the number of votes given.

Art XLI. The Board of Instruction proceeds in accordance with the rules laid down in the above Article whenever it has to present any candidates, and conformably to Art. 9, 23, 26, 38, 45, and 71, of the present decree.

TITLE V.—*Government, Police, Discipline.*

Discipline, &c.

Art. XLII. The Polytechnic School is subject to military rule.

The pupils are barracked, and form four companies; their uniform is determined by a ministerial order.

Art. XLIII. The heads of each study-room (*salle d'étude*) are chosen from the pupils, and appointed by the Commandant, according to their rank of admission or classification. They bear the title and wear the insignia, of sergeant-major, quartermaster-sergeant, (*sergent fourrier*), and sergeant; when under arms, they perform the duties of these grades.

Art. XLIV. Four times a-year a council, consisting of—

The Commandant of the School, Chairman,
The Second in Command.
The Director of Studies,
The six Captains, as Inspectors of Studies,

draws up for each student a tabular statement containing—

1. The marks relative to his application and progress;
2. The marks relative to his conduct and general bearing (*tenue*).

The number of days during which the pupil may have heen placed under arrest or in imprisonment during the preceding quarter, as well as the reasons for the punishment, must be noted down in the statement.

The second and fourth tabular statements of every year must likewise indicate the order of merit of each Student in the last half-yearly classification.

The above statements are forwarded to the family or to the correspondents of the pupils. A report of the whole is addressed to the Minister.

Council of Discipline.

Art. XLV. A Board or Council of Discipline is specially established to decide upon the cases of pupils who, by serious faults, or habitual misconduct, might endanger the order of the School or disturb the studies.

The Board of Discipline consists of nine members, as follows:—

The Second in Command, Chairman,
The Director of Studies,
Two Professors,
Three Captains of the School,
Two Captains of the Army, formerly Students at the School.

The duties of Reporter to the Board are performed by one of the Captains of the School, chosen from those who are not members of the Board. He has no vote.

The two Professors, members of the Board of Discipline, are nominated by the Board of Instruction. The Captains of the School are appointed by the Commandant, by turns and according to seniority. The Captains of the Army are appointed by the Commander of the 1st. Military Division of the School upon the request of the Commandant of the School.*

The removable members are to be changed yearly, when the School re-opens.

Art. XLVI. The Board meets on the direct summons of the Commandant.

For the transaction of business the members must be all present. No member can absent himself from the meetings without a legitimate reason, which he is bound to communicate without delay to the Commandant.

The absent members are replaced by functionaries of the same class appointed beforehand as supplementary members.

The military members attend in uniform.

Art. XLVII. Any pupil who, in consequence of habitual misconduct, or of a serious fault, has rendered himself liable to dismissal from the School, is summoned before the Board of Discipline.

Art. XLVIII. When a pupil is brought before the Board of Discipline, the first act of the latter is to hear the report drawn up concerning the usual behaviour of the student, and the facts in consequence of which he appears before the Board. The Board is like-

* France is divided into 21, and Algeria into 3 military divisions. The head quarters of the 1st Military Division is Paris. See the Annuaire Militaire, p. 84.

wise bound to consult the register of his punishments and the marks awarded to him since his admission to the School.

The Board is also empowered to demand any sort of written or verbal information which it may deem necessary in the interests of the discipline of the School, or of the pupil brought before them. The latter is at liberty to offer his defence.

Art. XLIX. When the Board deems itself in possession of full information, the Reporter, together with the witnesses and pupil, must retire; whereupon the Board proceeds to its deliberations, and votes by ballot.

Art. L. A majority of two-thirds of the votes is required to propose the dismissal of a pupil. The decision is given by the Minister of War. A pupil who has been once sent away in accordance with the above articles can never be re-admitted.

Title VI.—*Passage from one Division into the other, and Departure from the School.*

Art. LI. Every year, when the lectures and studies are completed, the students undergo examinations.

The Examinations in the studies of the first year are intended to show the capacity of the pupils for commencing the studies of the second year. Those of the second year show what pupils may be admitted into the public service.

Art. LII. The pupils belonging to the second year (First Division) make known, immediately after their examination, which branch of the public service they would prefer, as also, in what order they would make their selection among the other branches. Choice of service.

Art. LIII. Each of the five Examiners of Students undertakes one examination in the First Division, and one in the Second Division, upon the subjects detailed in Article 21 of the present decree.

Art. LIV. Delegates from the public services which are recruited from the School are called upon to attend at the examinations for passing from one division into the other, as well as at the Final Examinations before the students leave the School. The object of their attendance is, that they may ascertain whether the tendencies of the teaching, the character and extent of instruction acquired by the students, are such as are required by the exigencies of the public service.

The Delegates are ten in number: two from the Artillery, two from the Engineers, two from the Navy, two from the Roads and Bridges, and two from the Mining Department. They are appointed by the Ministers under whose authority the different services which they represent are placed.

Art. LV. The members of the Committees or Superior Councils of such corps as are recruited from the Polytechnic School, the various functionaries, officers, and professors of the Polytechnic School, as well as those belonging to the Schools of Application, are entitled to be present at the examinations of both divisions.

Art. LVI. Every Delegate of the public services attends at all the examinations passed by the pupils of the same division before the same examiner. The presence of the Delegate, or, in case of his absence, of a deputy, is indispensable for the validity of each examination. The Delegates who are called upon to be present, in the First and Second divisions', at the examinations of the same Examiner, must not belong to the same service.*

Art. LVII. The Examiners alone must put the questions and award the credits which are to determine the classification.

Exceptionally, a ministerial order may decide, upon request made by the Board of Improvement, that the examinations on certain special and practical courses, or on certain subjects not included among those allotted to the five Examiners by Art. 21, shall be undertaken by Delegates from the public services, or by persons specially selected for that purpose.

Art. LVIII. Upon proposals made by the Board of Improvement, the Minister of War fixes the mode of proceeding in the examinations, as well as the relative functions of the Examiner and Delegate.

He also determines the proportions in which the credits obtained in each branch of instruction in every description of work or other test shall enter into the elements deciding the classification by order of merit, whether for the passage from one Division to another or for admission to the public services.

Art. LIX. At the close of the examinations, each Delegate draws up a report of those at which he attended, and states the general result of his observations. He likewise must produce his notes upon each of the students, and mark down those who may appear, either as regards the present or the coming year, not to fulfil the conditions of capacity required in the service represented by the delegate.

Art. LX. A jury is formed to draw up the list of passage from the Second to the First division; another jury draws up the list of classification in the public services.

Each jury consists of—

The Commandant of the School, President,

The Second in Command,

* The five examiners take five different departments. Each examiner is attended by one delegate, who attends all the examinations in this examiner's department for the one year; another delegate attends him in like manner for the other year. But the two delegates attending one examiner must not come from the same service.

APPENDIX A.

The Director of the Studies,
The five Examiners of Students.
Four Members of the Board of Improvement, elected by the Board, two belonging to the military, and two belonging to the civil members.

The five Delegates of the public services who have been present at the examinations are likewise members of the one or the other jury.

Art. LXI. The jury strikes out of the list for promotion into the First Division, as well as out of the List of Departure, all such pupils as have not fulfilled every condition of instruction laid down by the rules. These pupils are struck out of the books of the School, unless their cases admit of their passing a second time through one of the years, in accordance with the 32nd Article.

Art. LXII. The jury declares the admissibility or inadmissibility into one, or several, or all the public services, of such pupils belonging to the First Division as have been noted down by one or several Delegates as not fulfilling every condition of capacity. Any pupil liable to an infirmity incapacitating him for the military services can never be appointed to those services.

Art. LXIII. The jury is likewise called upon to give its opinion upon the presumed capacity for the public services, of such pupils of the Second Division as have been declared admissible to the First, and who are to leave the School at the end of the ensuing year.

Art. LXIV. The names of the pupils of the First Division who are declared by the jury to be inadmissible to the public services, do not appear upon the final List of Departure, which determines the classification in the different services.

Those pupils also are excluded from the same list, who, after being pronounced inadmissible to certain services, would not be able, on account of their rank on that list (Art. 66) to obtain admission to such services as they are fitted for.

The pupils thus struck out of the list, are entitled, on application, to an attestation of capacity, when their exclusion is not grounded upon a deficiency in point of instruction.

Art. LXV. The decisions given by the jury excluding any student from promotion into the First Division, or from the final List of Departure, are definitive, and cannot be modified.

Art. LXVI. The lists of classification by order of merit being once established, the students whose names stand on the List of Departure are distributed among the several branches of the public service, as far as the vacancies will allow. They are appointed according to their order of merit, to the service they had originally selected; or, in case of no vacancy in that branch, to the service they had placed next in order in the list of preference made in their declaration described in Art. 52.

Art. LXVII. Before the jury closes its operations, every Examiner presents to them a detailed report concerning the results of the examinations in each Division. These reports of the Examiners, as well as the observations to which they may have given rise on the part of the delegates and other members of the jury, are transmitted to the Board of Improvement and the Minister of War.

Art. LXVIII. Such students as have been declared admissible to the public service, and who, from the non-existence of vacancies are not nominated to one of the services enumerated in the 1st Article of the present decree, are entitled (Articles 3 and 25 of the Law of April 14, 1832) to an appointment of Sub-lieutenant in the army, or in the navy, in the corps not included in the above Article 1. These pupils may be admitted at the School of Woods and Forests (*Ecole Forestière*), or allowed to follow the oral lectures delivered at one of the civil Schools of Application.

Allowance for equipment.

Art. LXIX. Upon request made by the Boards of Administration and Instruction of the School, each exhibitioner, or half exhibitioner, who has received an appointment as officer, after passing a satisfactory examination, may obtain a sum appropriated to the first outlay for military equipment, equal to that which is allowed in the arm of the service which they enter, to non-commissioned officers who are promoted to be officers.

Title VII.—*Administration and Accounts.*

Council of Administration.

Art. LXX. A Board of Administration has the superintendence and regulation of all the administrative concerns of the School.

Art. LXXI. The Board consists of—

The Commandant of the School, President,
The Second in Command,
The Director of Studies,
Two Professors, appointed by the Board of Instruction,
Two Captains, chosen by turns, according to seniority.

The Manager (*Administrateur*) and Treasurer are Members of the Board; the former as reporter, and voting with the others; the latter, with a right of discussion, but not of voting (*avec voix consultative*).

The removable members of the Board are renewed by halves every year. The Board meets upon the summons of the Commandant.

The provisions of the 39th Article are likewise applicable to the Board of Administra-

tion; and it also conforms to those of Article 40, whenever it has any presentation to make, in accordance with Article 26 of the present decree.

Art. LXXII. The appropriation of the funds assigned to the School is intrusted to the above Board, which superintends all the minutiæ of internal administration.

Art. LXXIII. The Commissariat Department is charged with the administrative inspection of the School, upon the same principles and regulations which are observed in the various corps of the army.

Title VIII.—*General Arrangements.*

Art. LXXIV. The Minister of War is empowered to draw up special regulations, founded upon the present decree, to determine everything relative to the internal order, the discipline, administration, and accounts.

Art. LXXV. Every year a General of Division is charged with the general inspection of the School, in regard to the service, discipline, administration, and accounts. A Commissary General (*Intendant Militaire*)* inspects the administration of the School. Inspection of the School.

Title IX.—*Temporary Arrangements.*

Art. LXXVI. Existing functionaries of the School, who, in accordance with the tariff annexed to the present decree, would receive a smaller remuneration than they previously enjoyed, shall be liable to no diminution as long as they continue to hold their present appointments.

Art. LXXVII. The Examiners for Admission, who hold their office under the Ordinance of October 30, 1832 (Art. 13), do not require re-appointment.

Art. LXXVIII. The salaries of any subordinate officials who were previously liable to deduction in favour of the pension fund, shall still be subject to the same liability.

The pension to which they may be entitled shall be paid in accordance with the rules followed in regard to the officials of the Central Office of the War Department.

Art. LXXIX. The Mixed Commission established by the decree of November 4th, 1850, shall continue down to the 31st of December 1852, to fulfil the duties assigned to the Board of Improvement in the present decree.

Art. LXXX. All clauses and dispositions contrary to the present decree are abrogated and annulled.

Art. LXXXI. The Ministers of War, of the Navy, of the Home Department, and of the Public Works, are charged, within the limits of their functions, with the execution of the present decree, which shall be published in the "Bulletin des Lois."

(Signed) LOUIS NAPOLEON.

The Minister of War,
(Signed) A. de St. Arnaud.

Decree modifying the 38th Article of the Decree for the Re-organization of the Polytechnic School.

Palace of the Tuileries, December 26, 1852.

Napoleon, by the grace of God and the will of the Nation, Emperor of the French, to all present and to come, greeting:—On the report of our Minister of State for the War Department; considering the decree dated November 1st 1852, for the re-organization of the Polytechnic School: considering that if it be necessary to include in the Board of Improvement of that School the representatives of each science taught and method practised there, as well as the delegates of the public services which the School is destined to supply, it is likewise necessary that all such members should hold their appointment from the Government, which is responsible for the direction of the School, We have decreed and decree as follows:—

Art. I. The two Delegates of the Academy of Sciences, the two Examiners of Students, and the three Professors of the School, who are named in the 38th Article of the above-mentioned decree, are chosen by the Minister of War.

Art. II. Our Minister Secretary of State for the War Department is charged with the execution of the present decree.

(Signed) NAPOLEON.

By the Emperor:
The Marshal of France, Minister Secretary of State for the War Department.
(Signed) A. de St. Arnaud.

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* The commissariat or *intendance* consists of three classes, *Intendants militaires, Sous-Intendants militaires,* and *Adjoints à l'intendance, militaire,* the two latter each divided into a 1st and a 2d class. See Vauchelle, I. 59; Annuaire militaire, 1855, p. 55.

APPENDIX B.

Internal Regulations for the Polytechnic School.

(1844.)

Title I.—*The Staff.*

Art. I. The staff of officers attached to the direction of the School, to the medical service, tuition, and administration, is regulated by the Articles 14, 16, 17, 19, 20, 22, 23, 24 of the Constitutive Ordinance, dated October 30, 1844; and by the ministerial order of November 23, 1844, which appoints a certain number of non-commissioned officers to fill the functions of sub-adjutants, guard, and porter at the School.

Title II.—*Government of the School.*

Chapter I.—*On the Admission of the Pupils.*

Art. II. On the day when the pupils present themselves at the School, in order to fulfil such formalities as are required for admission, they undergo the inspection of the Surgeon, seconded by the assistant-surgeon. The Officer Second in Command must be present at the inspection. Its object is to ascertain—

1. Whether they do not labour under any disease or infirmity which might prove an obstacle to their admission;
2. What is the degree of strength or weakness of their constitution;
3. What is the nature of any disease or infirmity they may be subject to.
4. How far they may be shortsighted.

Art. III. The result of the above inspection is registered in a book destined for the purpose of stating whether the pupil is fit for the military service, for the civil services, or for no service whatever.

Every student signs his name on the margin of the statement.

This book, or register, after being certified to by the Second in Command, is hereafter consulted for the classification in the public services.

Art. IV. Such pupils as are registered as incapacitated for any public service, are subjected to a second inspection.

For this second inspection, the Minister appoints some medical officers different from those attached to the School; the Commandant and two officers of the School must attend during the visit. The same arrangements apply in the case of those pupils who are registered as unable to enter the military service.

A certificate attesting the latter inspection, and an extract of the register mentioned in the 3rd Article, are forwarded by the Commandant, together with his own opinion, to the Minister, who determines upon the case.

Art. V. At the Final Examinations, previous to leaving the School, the students who are to enter upon the military services, are likewise submitted to a second inspection, in order to ascertain whether their constitution or bodily conformation qualifies them for those services. This latter inspection takes place with the same formalities as those mentioned in the 4th Article.

Chapter II.—*The Divisions of the Students.*

Art. VI. The students of the Polytechnic School form a battalion containing two Divisions or companies. The First Division consists of those students who follow the courses allotted to the second year; whilst those of the Second Division attend the courses of the first year.

Art. VII. In each Division the students are distributed into a certain number of rooms, for study; of dormitories, for sleep; of tables, for meals; and of laboratories, for the chemical manipulations. The whole Division assembles in the same amphitheatre for the oral lectures, and in the same class-room for the drawing lessons.

Art. VIII. The places occupied by the students in every part of the establishment are assigned by the Second in Command, in pursuance of an order issued by the Commandant; no pupil is allowed to change his place without permission from the above officer.

Art. IX. In each company, the staff consists of a Captain, an Adjutant, a Sergeant-Major, a Quartermaster-Sergeant, and six Sergeants; the number of the latter may, however, be increased if the number of studying rooms (*salles d'étude*) shall require it.

Chapter III.—*The Student-Officers.*

Art X. The Sergeant-Majors, Quartermaster-Sergeants, and Sergeants are exclusively chosen from among the students; they are appointed by the Commandant.

They are expected to show themselves deserving of this honourable distinction, and expose themselves to lose it through misconduct, or by bad marks at the School-examinations.

Those who have placed themselves in such a situation, are deprived of their rank by the Commandant, and the determination taken against them is made known to the School by an order of the day. The Minister is informed of the circumstance.

Art. XI. The above students wear the insignia belonging to their respective ranks in the army, and when the company is assembled, they take up their posts in the places assigned by the military regulations.

The other students assume, in the ranks, the places assigned to them by the Captain in command.

Art. XII. In each studying room (*salle d'étude*) one of the pupils bearing a grade takes the place of chief. As far as it is feasible, a graded student is also placed in each dormitory, in each laboratory, and at every table. In case of there being more than one in any of these places, the title of chief or head student belongs to the one who holds the highest place on the list of merit.

Art. XIII. The head students transmit to the pupils of their respective rooms every order and communication for which the superiors deem it advisable to use their services.

Art. XIV. All collective applications are prohibited; consequently the head students are not allowed to carry up to the superiors any demands or claims of their fellow students, whatever may be the nature of such demands.

Art. XV. The head students deliver receipts of such works belonging to the library, as well as of such engraved or relievo models as are deposited in each class room for the general use of the pupils.

They attend to the preservation of the above objects, as likewise as to the execution of the regulations, orders, and instructions placarded in each room, or entrusted to their care.

They distribute among their fellow students the objects which are necessary for their studies. They draw up a list of such pupils as are desirous of taking their meals at the School on holidays, and all other lists, that may be required by their superiors.

They sign their names to a statement of those objects which are to be repaired or replaced at the common expense of the pupils in each room, in pursuance of the provisions laid down in the 49th Article of the present regulations.

Art. XVI. The head students collect, in a portfolio destined to that purpose, all the drawings which the students are called upon to do, and deliver them, at certain determined periods, into the hands of the Captain on duty of their Division.

At the close of every literary task, they likewise collect the compositions, and deliver them as above mentioned.

They collect the note-books used by the students during the lectures, and transmit them, five minutes after each lesson, to the Captain on duty of their Division.

Art. XVII. Two Student-officers, one belonging to each Division, assist daily the Adjutant who has to receive the provisions supplied for the meals of the School.

They may offer verbal observations concerning the quality of such articles to the Adjutants, and even to the officers on service. But in no case whatsoever can they apply directly to the agents of the School, or to the contractors.

Art. XVIII. When there are no Student-officers, or in case of their absence, the Commandant of the School appoints some other students to fulfil their duties.

Art. XIX. The heads of each room, table, and laboratory are bound to the same duties as those assigned to the heads of the studying rooms.

Chapter IV.—*Dress.*

Art. XX. No student can appear, either within or without the School, unless it be strictly in the dress prescribed by the regulations.

Art. XXI. Every part of the uniform must be conformable to the patterns decided on by the Minister.

APPENDIX B.

Art. XXII. Such pupils as have a beard must shave at least on Sundays and Wednesdays, preserving the moustaches and royale.

The hair must be cut short, and according to a uniform manner.

Art. XXIII. No sort of shoes or dress may be introduced into the School, nor worn by the pupils, unless the Captain charged with the superintendance of the dress has previously ascertained that the rule laid down in the 21st Article has been strictly observed.

Art. XXIV. Any articles of dress which may be spoilt in consequence of negligence on the part of the students, are repaired or replaced at their expense, and in a space of time determined by the officer who superintends that department.

The cleaning of their clothes falls likewise to their own cost; but for any other repair in clothes the Master Tailor is responsible.

The Officer charged with the clothing department shall decide upon any question which may arise on this score.

Art. XXV. Every article, both of full dress and undress, must always be in a fit state of cleanliness, and never remain torn or without buttons. The students must beat and brush them carefully.

Their shoes must also be kept in good condition.

Such articles of dress as are not worn, must be carefully folded up. The students are expected to attend constantly to the cleanliness of the cupboards and shelves destined to receive them.

Art. XXVI. Every three months the Officer charged with the duty passes a minute inspection of the dress in each ward during the hours of recreation.

Art. XXVII. The students are strictly forbidden to put on articles of dress, either not belonging to them, or bearing no distinctive mark.

Art. XXVIII. The administration of the School pays for the washing of two pair of white trowsers a week for every pupil. Extra washing is paid for by the pupil. Undress trousers for summer are washed once a month.

Chapter V.—*Subordination and Discipline.*

Art. XXIX. The students are bound to obey and respect the officers, adjutants, and sub-adjutants, functionaries, professors, assistant teachers (*répétiteurs*), and masters attached to the School.

Any insult, any impertinent answer addressed to the non-commissioned officers and subordinate officials (whether military or civilians) attached to the School will be punished with severity.

The pupils must obey previous to making any complaint; all complaints must be personal and addressed in writing to the Captain on duty. In case that officer should refuse to receive the complaint, the pupil may apply to the Second in Command.

Art. XXX. The students salute the officers, adjutants, and sub-adjutants, functionaries, assistant teachers (*répétiteurs*), and masters.

They are bound to show the same mark of deference to all officers of the army.

In any other place but the amphitheatres, whenever the Commandant of the School, the Second Officer in Command, or the Director of the Studies, happen to attend, the students, when seated, must rise immediately to salute them.

Art. XXXI. All requests, whether oral or written, must be addressed by the pupils to the Captain on duty in their Division. These claims must always be personal.

Art. XXXII. In whatever place they may be, the students are bound to abstain from any words or acts tending to disturb public order or internal tranquillity in the School.

Art. XXXIII. Any student who proceeds to acts of violence against one of his fellow students, or who challenges him to a duel, shall be dismissed from the School; the Board of Discipline has merely to state the fact.

In case of a duel between two students, if any doubt exist as to the author of the provocation, both may be dismissed.

Art. XXXIV. Any association, deliberation, or collective application, any circular or attempt tending to provoke the students to any of the above acts, is strictly prohibited.

The students are not allowed to raise any collection or subscription, to form any meeting without the precincts of the School, to attend, even through deputations, at any ceremony or banquet, without the previous consent of the Commandant.

They can neither give out any paper to be printed, nor can they insert any in the periodical publications.

Art. XXXV. All pupils who are found in possession of any of such circulars or papers shall be considered as particularly culpable of the acts specified in the preceding article.

Art. XXXVI. Cards, dice, and all games of chance, whether for money or not, are prohibited within the premises of the School, even in those parts allotted to recreation.

Art. XXXVII. The same prohibition extends to the introduction of newspapers, periodicals, pamphlets, or circulars, books, and drawings, alien to the studies; to all articles of dress not included in the uniform; to all moveables; eatables, wines, and spirits; to instruments of music, medicines, chemical products, and utensils and apparatus for chemistry.

Art. XXXVIII. Smoking is only allowed during the hours of recreation, and nowhere but in the play-grounds, or under the covered gallery.

Art. XXXIX. Any sign of approbation or disapprobation, any noise, song, or disorder, are strictly prohibited at all hours and in all places.

Art. XL. The students must always repair in an orderly manner to the studying rooms where they are expected to attend. Loud conversations, or other acts tending to disturb the requisite degree of attention, are strictly forbidden, alike in the studying rooms, the amphitheatres, and the corridors.

Art. XLI. The same prohibition is extended to the reading of any book in the amphitheatres, even when such a book refers to the object of the lessons.

Art. XLII. No student is allowed, unless by special permission, to enter any place appropriated to the Division which he does not belong to, or any studying-room other than his own.

Art. XLIII. Any long absence from the studying-rooms, amphitheatres, drawing-room, laboratories, or any other place of attendance, is liable to punishment proportioned to the time of absence.

Art. XLIV. The drum beats the signal for every attendance which the students have to go through in the course of the day, in pursuance of the time-table prescribed by the Minister. The names are called over, in order to ascertain whether the pupils are all in attendance.

Art. XLV. The students can only be called to the parlour on certain days, and at certain hours. The Commandant, or the Second in Command, can alone issue permissions to persons for visiting the pupils.

Art. XLVI. After the lights have been put out every sort of conversation must be given up in the rooms, the most complete silence must prevail, and no light be kept.

Art. XLVII. Any defacement or damage done to the buildings, furniture, articles of clothing, books, or objects of instruction, &c., is repaired at the expense of the delinquent.

Art. XLVIII. When several students have occasioned any damage of the above kind, the payment is divided equally among them.

Art. XLIX. If the objects damaged are objects appropriated to the use of the pupils occupying one studying room, dormitory, laboratory, or the like, and if the doer of the damage remains unknown, the charge of repair is borne by all the students who enjoy the use of the above objects.

Art. L. A tariff of all such cases of damage is previously laid down by the Board of Administration, and placarded in the rooms of recreation as well as in the cabinet of the officers on duty (*cabinet de service*).

Art. LI. A copy of the present regulations, together with the collection of the particular measures enacted by the Commandant of the School in pursuance of the 245th Article, is delivered into the hands of the head student in every class-room, in order that all the pupils may be duly acquainted with them.

Art. LII. Every infringement of the directions given in these present regulations, orders, and instructions, is liable to punishment proportioned to the offence. No plea of ignorance is admitted.

Art. LIII. All the students of a studying-room, dormitory, laboratory, or refectory, and, in fact, the whole body of students belonging to one of the two Divisions, are responsible for infractions when the real culprits remain unknown.

Art. LIV. At the close of the school year, the Commandant of the School, the Second in Command, and a Captain appointed by the Commandant, are to meet under the presidency of the Commandant, in order to award to every pupil a mark of conduct founded upon the entries in the book of punishments.

Chapter VI.—*Punishments.*

Art. LV. The punishments to which the students are liable are the following:—

Arrests; the guard-room; publication on the order of the day; imprisonment in the School; military imprisonment; expulsion from the School.

Art. LVI. Arrests consist in being deprived of permission to go out on general holidays. Deprivations of this kind on Wednesdays are reckoned as one arrest; on Sundays or other festivals they count two.

Art. LVII. The students who are under arrest are obliged to conform themselves, in regard to the hours allotted to study, to the time-table of days not holidays. In general, they may study as they please, but the subject may be previously determined; and these studies are under the same regulations as any others.

APPENDIX B.

Art. LVIII. The punishment of the guard-room deprives the delinquent of his liberty on holidays in the same manner as the arrest does. He is detained in a room in which he takes his meals and sleeps. His food is the same as that given to the other students. This penalty counts for one day on Wednesdays, for two on Sundays and similar festivals.

Art. LIX. The punishment of the guard-room is never inflicted but on days of general leave of absence; it begins on the first holiday following upon the day when the penalty was awarded, and is continued without any interruption until their final expiration. During the whole time, the delinquent can obtain no exceptional leave of absence, nor can be called to the parlour.

Art. LX. Publication on the order of the day, consists of a severe reprimand of a student's misconduct, announced publicly on the orders.

Art. LXI. Imprisonment in the School deprives a student of his liberty of going out, even within the premises of the establishment, except in the case laid down under Article 62. The above penalty begins as soon as it is inflicted and is never interrupted.

Art. LXII. When imprisoned, the delinquent sleeps on a field-bed provided with a single straw mattress. He is visited, at his own request, by one of the medical officers attached to the School. Except on Sundays, the student who is under imprisonment is allowed half an hour's walk in the play-grounds during the time devoted to study, and under the superintendance of an adjutant. He receives the same food as the other pupils.

Art. LXIII. The student punished by military imprisonment is conducted to the prison by an officer, or by an adjutant, who sees that he is entered upon the gaol-book. From that moment he is entirely subjected to the discipline of the prison. He is visited at least every other day by an officer belonging to the staff of the School, or by an adjutant who takes care that the prisoner receives his linen, and such objects as may requisite for the prosecution of his studies.

Art. LXIV. The adjutants may inflict the punishment of arrest; the Captains that of arrest and the guard-room; the Officer Second in Command, of arrest, the guard-room, and imprisonment in the School. A report of the above punishments is drawn up and sent to the Commandant.

The Commandant may inflict every sort of punishment except expulsion from the School. When he sends a student to the military prison, he immediately forwards a statement of the facts to the Minister of War.

Expulsion from the School is ordered by the Minister, upon application made by the Board of Discipline, and in pursuance of the rules laid down in the Ordinance of Organization.

Art. LXV. The Adjutants can never award more than four days of arrest for one single delinquency. The Captains may inflict six days of simple arrest and four days in the guard-room.

The Second in Command may award twelve days of simple arrest, eight days in the guard-room, and four days of imprisonment in the School.

The Commandant may increase or diminish the punishments; he is also at liberty to alter, or even annul them, though he is never empowered to award more than a fortnight of internal or of military imprisonment. The Minister may, if he deems it proper, prolong the duration of the latter penalty.

Art. LXVI. The Director of the Studies, and other members of the educational staff, the functionaries, and sub-adjutants, must send up, in writing, a request for the punishment of such students as they have to complain of. The request is forwarded by the Director of Studies to the Commandant, and by the sub-adjutants to the adjutants on duty. All other functionaries apply to the Second in Command.

Art. LXVII. Entering late at night is punished. Every student who sleeps out of the establishment incurs for the first time a severe punishment; if the offence is repeated, he is summoned before the Board of Discipline, who pronounces, if requisite, his expulsion from the School.

Art. LXVIII. On holidays, the adjutant on duty calls over, at no fixed hour, the names of such pupils as have been kept in, either in consequence of punishments or ill health.

Art. LXIX. Punishments must be always proportionate to the degree of offence. A repetition of the fault is followed by severer punishment. Any student who exposes himself to frequent punishments, or who has incurred on several occasions the penalty of imprisonment, is summoned before the Board of Discipline.

Art. LXX. Punishments are merely suspended when the students go into the Infirmary.

Art. LXXI. Pupils who, after undergoing their examinations at the end of the year, have not yet completed their punishments, are not allowed to leave the School before going through the whole. In such cases, the punishments of arrest and the guard-room are inflicted on any day without exception.

Art. LXXII. Collective penalties, awarded in order to punish faults committed by unknown delinquents, cease when the culprits confess their fault after a very short delay.

Chapter VII.—*Studies, Interrogations, and Examinations.*

Art. LXXIII. Every student is expected to take notes upon the lectures given by the Professors, as they are going on.

Art. LXXIV. During the scientific drawing, no pupil is allowed, unless by special permission, to copy drawings not of his own doing, to help a fellow student in his drawings, nor to obtain help in his own.

Art. LXXV. During the course of the year, the pupils are frequently summoned to the interrogation chambers (*cabinets d'interrogation*) to be questioned individually, both by the assistant teachers (*répétiteurs*) and professors, on the different parts of the lectures. As far as possible, they are all questioned an equal number of times.

Art. LXXVI. At the close of every course, or division of a course, the pupils undergo a general examination on the branches included in such courses, or divisions of courses.

Art. LXXVII. Any student who suffers one of his fellow pupils to appear in his stead, exposes both himself and his friend to severe punishment.

Art. LXXVIII. Dispensations from tasks, or allowances of extra time for their fulfilment, may be granted by the Second in Command, in case of absence with leave or of illness under treatment at the Infirmary. Similar motives may justify a dispensation or allowance of time in the case of the interrogations. Imprisonment or arrests can never be pleaded as a reason for such indulgences.

Art. LXXIX. Each pupil receives marks of merit for the private and for the general interrogations, due respect being likewise paid to the verbal answers, and to the written notes taken down at the amphitheatre. The Professor or assistant teacher, is always bound to have these notes produced to him. These marks, or numbers of merit contribute, together with the marks awarded for conduct (Art. 54), and in a proportion determined beforehand, to classify the pupils, either on passing from one Division into the other, or on leaving the School.

Art. LXXX. Every pupil whose mark is zero, either at the interrogations, or for the French, German, or English compositions, or again, who does not deliver up his composition at the stated time, is liable to punishment.

Art. LXXXI. Every quarter the students are ranked according to their respective merit; the classification is grounded upon the average number of marks which they have obtained in each branch of instruction during the three preceding months.

Art. LXXXII. At the expiration of the school year, the pupils of each Division undergo four examinations, which give rise to four different classifications. These examinations bear upon: 1, Analysis and Mechanics; 2, Descriptive Geometry, Machinery, and Geodesy; 3, Natural Philosophy; 4, Chemistry.

Art. LXXXIII. The final classification is established by combining the classifications mentioned in the preceding article with the marks awarded in the course of the year to every branch. In the First Division the marks awarded when those pupils passed from the first to the second year of the studies, are also taken into calculation.

Art. LXXXIV. The quarterly and annual classifications are communicated to the pupils, together with the marks which served to establish their rank.

Art. LXXXV. When the Board of Instruction is of opinion that a pupil, on account of his incapacity, requires to repeat the course of studies allotted to one year, in conformity with the 28th Article of the Ordinance, dated October 30, 1844, the aforesaid Board lays before the Minister, in favour of the pupil, a request, grounded upon sufficient motives, and supported by a certificate stating his residence at the infirmary; or in case of absence from the School, by certificates of inspection, stating the character and duration of the illness under which he has laboured.

Chapter VIII.—*The Scientific Collections and Library.*

Art. LXXXVI. During the school year the pupils of both divisions are allowed to examine the different instruments and apparatus used in Natural Philosophy, the collections of Chemistry, Mineralogy, Machines, and Models.

Art. LXXXVII. The students are never admitted to visit the scientific collections but when duly authorized thereto by the respective Captains of their divisions. They must apply their attention exclusively to the models or instruments which they have asked for.

Art. LXXXVIII. At certain periods, determined by the Commandant, the students belonging to the First Division visit some public or private establishments which may offer special interest for their instruction. On such occasions the pupils must be always accompanied by a Captain and an Adjutant, or, if necessary, by a Professor or Assistant Teacher (*répétiteur*).

Art. LXXXIX. The library is open to the pupils during five hours on Sundays and other holidays, and for two hours on every other day. It is likewise open every day during seven hours to such pupils as, after undergoing their yearly examinations, remain at the school.

Art. XC. The Librarian may authorize such pupils as request it to take away certain scientific works recommended, at the beginning of the year, by the Director of the

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Studies, and drawn up in a list which is placed both in the library and in the cabinet of the officers on duty.

Art. XCI. The pupils who are in the infirmary are allowed to receive books from the library, if the Physician allows them to read.

Chapter IX.—*Bodily Exercises and Accomplishments.*

Art. XCII. During the hours of recreation, the pupils are taught, though without arms, the different military manœuvres, as well as gymnastics. Gymnastics are taught particularly on holidays.

Art. XCIII. The Masters of Gymnastics are appointed by the Minister of War.

Art. XCIV. Lessons in fencing, music, and dancing are optional, and paid for by the pupils. They are given during the hours of recreation by Masters appointed by the Commandant.

Art. XCV. The conditions relative to the number, time, fees, and payment of such lessons are regulated by the Board of Administration, and made known to the pupils. The lessons are paid to the Masters by the Cashier of the School, upon the presentation of cards signed by the pupils, and certificated by the Captain who superintends this branch of the service. Parents are obliged to pay the requisite funds in advance into the Cash Office.

Chapter X.—*Leave of Absence and Holidays.*

Art. XCVI. Wednesdays, Sundays, and other festivals, are appointed for days of general leave of absence. On Wednesdays the pupils may leave the school at half-past two, and must return at nine o'clock.

On Sundays and other festivals they are allowed to leave immediately after the inspection, and must return by ten o'clock at night.

Art. XCVII. No leave of absence can ever be prolonged.

Art. XCVIII. In some very rare cases, and on account of urgent family affairs fully proved to exist, the Commandant may grant a student an extra leave of absence, not exceeding one week.

Art. XCIX. Leave of absence in consequence of illness, can never be granted but by the Minister, at the request of the Commandant of the School, and on certificates delivered by the medical officers. However, the Commandant may grant leave of absence for a fortnight for the sake of recovery.

Art. C. All holidays or leaves of absence, of whatever kind, may be suppressed by the Commandant when he deems it necessary.

Chapter XI.—*On the Medical Service.*

Art. CI. The service of the infirmary is under the direction of the Surgeon, with the aid of the Assistant Surgeon. The details of the service are intrusted to the care of Sisters of Charity.

Art. CII. In case of illness every student must be sent to the infirmary, unless it be a trifling indisposition likely to yield to prescriptions which can be easily followed.

Art. CIII. Pupils whom the Surgeon or Assistant-Surgeon state should be kept in on account of health are not allowed to leave the school on holidays.

Art. CIV. During the course of the year, at certain periods, determined upon by the Commandant of the School, all the pupils are subjected to the inspection of the medical officers. A similar inspection takes place previous to the examinations at the end of the year.

Art. CV. No pupil is allowed to consult the medical officers at their houses, in the interval between one inspection and another. In urgent cases, the Captain upon duty sends for the Assistant Surgeon, and if that officer be absent, he sends the ailing student to the Infirmary.

Art. CVI. Strangers to the School are not allowed to visit the pupils at the Infirmary, unless it be with a special permission delivered by the Commandant or the Second in Command, and, in the absence of that superior officer, by one of the Captains on duty.

Art. CVII. The relations or friends of the pupils may, if they so desire, have them visited by another physician than the one belonging to the school, but only after obtaining permission from the Commandant or the Second in Command. If the opinion of several physicians is deemed requisite, the Surgeon of the establishment takes part in the consultation, and the consequent prescriptions must be given by him alone.

Art. CVIII. After the last examinations, no pupil, unless he be claimed by his family, can leave the school without a certificate from the Medical Officers, stating that he labours under no complaint or ailment of such a character as would force him to be detained in the establishment.

TITLE III.—*The Powers and Duties of the Persons attached to the School.* APPENDIX B.

Chapter I.—*Officers of the Staff.*

Section I.—*On the Officer Second in Command.*

Art. CIX. The Second in Command is the intermediate agent between the Commandant of the School for the transmission and execution of orders in every branch of the service.

Art. CX. At the beginning of the year, he distributes the pupils in the Companies, and assigns to them their place in the studying-rooms, and other rooms which they will occupy. If he thinks proper, he allows the students to exchange places in the studying rooms, dormitories, and refectories.

Art. CXI. As often as it is advisable he visits the Infirmary, the studying-rooms, refectories, &c., is present when the provisions are brought in by the contractors, attends at the lessons of every description, and at the manipulations of Chemistry.

Art. CXII. He particularly directs his attention to the absence of pupils on account of ill health, or of their stay at the Infirmary, and in respect of exercises in drawing and interrogations, he grants the dispensations and allowances of extra time required in consequence of absences of the above kind. At the request of the Medical Officers, he may likewise grant the pupils dispensations in regard to wearing the uniform.

Art. CXIII. Every morning he makes his report to the Commandant on all that has taken place during the preceding four-and-twenty hours, and receives his orders.

Art. CXIV. Every day he attends the meeting of the Council of Order, in which the Captain and Adjutants on duty meet. He communicates to the Council the Commandant's orders, and prescribes such measures as are necessary for their execution.

Art. CXV. On Sundays and other holidays, he accompanies the Commandant through his inspection of the pupils, or himself superintends the inspection.

Art. CXVI. Every three months he assembles the officers in council, with a view of drawing up the notes which are to form the basis of the quarterly report on the behaviour of the pupils. The report is forwarded by the Commandant to the Minister of War.

Art. CXVII. He receives the Commandant's orders relative to the visits paid to the establishments alluded to in Art. 88.

Section II.—*The Captains.*

Art. CXVIII. The duties of the Captains include, under the authority of the Second in Command,

1. The superintendence of the students both within and without the hours of study, as also the preservation of order, and the execution of the several regulations;
2. The command of the companies;
3. The clothing department;
4. The general barrack department.

Art. CXIX. The division of duties among the Captains is determined by the Commandant. Independently of their ordinary duty, the Captains may be employed on special duties and missions.

Art. CXX. The Adjutants, Sub-Adjutants, Sergeants on guard and at the gate are under the immediate authority of the Captains. The Captains issue orders in everything relating to their service to the various subordinate officials, and see to the execution of them.

Art. CXXI. The superintendence of the Captains on duty extends to all the exercises and duties prescribed to the pupils by the regulations. The Captains who command the companies are bound to visit them daily, and to inspect them at least once a week during the recreation after dinner, exclusive of the review which takes place on Sundays and other holidays. They pay particular attention to the preservation and cleanliness of the dress and uniform in their companies. They always accompany the pupils when the latter go out in a body.

Art. CXXII. The Captains endeavour to be thoroughly acquainted with the character and disposition of the pupils, in order to supply, at the end of every quarter, ample and correct evidence for the drawing up of the above-mentioned report (Art. 116). When they deem it necessary, they give the pupil such advice and counsel as may contribute to maintain them in a proper direction, and note down any reprimand which they are obliged to address to them.

Art. CXXIII. They receive all requests and complaints made either by the pupils or by the subordinate officials belonging to the several services, immediately deciding upon such as fall under their own authority, and transmitting the others to those authorities whom they may concern. In case of any difficulty, they apply to the Second in Command.

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Art. CXXIV. One of the Captains on duty visits the Infirmary at least once a day. He also attends to any demand or complaint made by the pupils or by the persons attached to the medical service, and conforms himself in regard to any measures which he may adopt, to the rules laid down in the preceding Article.

Art. CXXV. The Captains on duty may allow two pupils in each division to pay a daily visit to their fellow students who are confined to the Infirmary. This, of course, cannot take place if the Surgeon has prohibited visits of this kind in his daily report. In case the Second in Command is absent, the Captains likewise deliver similar authorizations to the relations or friends of sick pupils, taking care, however, to conform to the regulations concerning the medical service.

Art. CXXVI. They may grant every day permission to one pupil in every studying room to hold communication during hours devoted to study with a pupil belonging to another studying room, when such communications contribute to mutual progress. They may also give out similar permissions for visiting the scientific collections, on conforming to the regulations laid down by the Commandant. They ascertain that the Keepers are present at the hours fixed upon for these visits.

Art. CXXVII. The Captains on duty sign their names on the tickets for the delivery of paper, pens, and other articles necessary for the students. They superintend the distribution and use of these objects.

Art. CXXVIII. A Captain on duty must always be present in the amphitheatres, drawing rooms, and laboratories; he likewise attends during the meals and at the roll call.

Art. CXXIX. When a student is reported absent from the evening muster, the Captain on duty immediately writes to the Second in Command, informing him of the circumstance. If a pupil has passed the night out of the school, the next morning he sends for information at the house of the pupil's family or correspondent, and reports without delay the result of his inquiries to the Second in Command.

Art. CXXX. The Captains on duty keep in each Division four books, on which they write down carefully day by day,—1st, The exchanges which take place among the pupils; 2nd, Their marks for interrogations; 3rd, The delivery of drawing-tasks, the delays in delivery, together with the reprieves and dispensations granted by the Second in Command for these duties as well as for the interrogations; 4th, The punishments awarded to the pupils, together with the reasons for such punishments.

Art. CXXXI. Every morning the Captains receive the reports of the Adjutants, Sub-Adjutants, Sergeants on guard and at the gate, and officials charged with the night rounds. With the help of these documents and of their own observations, they draw up a general report upon what has taken place during the last four-and-twenty hours. The report is brought by one of the Captains to the Commandant.

Art. CXXXII. The Captains on duty attend daily at the Council of Order mentioned in the 114th Article. They all attend on the Sunday morning.

Art. CXXXIII. Every Captain on duty ought to extend his superintendence, when requisite, to both Divisions.

Art. CXXXIV. When a Captain is prevented by any particular circumstance from going through his duties, he must apply to the Second in Command for a substitute.

Art. CXXXV. The Captains who are not on duty are nevertheless bound to repress within and without the School any fault with which they may become acquainted, and to contribute to the general order of the establishment. In case of any noise or tumult they repair immediately, and without waiting for orders, to the place where the disorder is going on, make use of their authority to repress it, and do all in their power to discover and make known the authors.

Art. CXXXVI. No Captain, even when not on duty, can sleep out of the establishment without the permission of the Second in Command, who reports the fact to the Commandant.

Section III.—*The Adjutants.*

Art. CXXXVII. The Adjutants are placed under the orders of the Captains, and take their place in the companies, when the latter are assembled.

Art. CXXXVIII. They exert the most vigilant superintendence over the pupils, both in the School and out of doors, in all points relating to the police, discipline, and behaviour.

Art. CXXXIX. One Adjutant is on duty every week, by turns, in charge of each division. But all the Adjutants may be called together for the service when such a measure is deemed necessary.

Art. CXL. The Adjutants have under their immediate orders the Sub-Adjutants, Sergeants on guard and at the gate, drummers, and servants.

Art. CXLI. Whenever the service requires it they may issue orders to the officer who takes charge of the food, and to other subordinate officials; but they inform the Captains of the fact; they must also make it known to these functionaries by whom they are usually employed.

Art. CXLII. They muster the pupils together and make them fall into order for every general meeting. They call one roll.

Art. CXLIII. When a pupil does not answer to his name in the studying rooms, the adjutants observe the time of his return and the cause of his delay. If the student does not return within half an hour after the roll-call, the Adjutant reports the case to the Captain on duty.

Art. CXLIV. The Adjutants read to the pupils in the studying rooms the orders of the day which they have received for that purpose, and make all communications to them that are ordered, charging the heads of the room to communicate them to any of the students who may be absent.

Art. CXLV. Every morning they make a report in writing to the Captains on duty upon all that has taken place during the last four-and-twenty hours. To these reports they add those which are sent up for the Captains by the Sub-Adjutants, Sergeants, on guard, and at the gate, and the officials charged with going the rounds at night

Art. CXLVI. The Adjutants on duty must attend at the daily Council of Order; and all of them must be present at the meeting on Sundays.

Art. CXLVII. They pay frequent visits to the interrogation chambers, in order to ascertain whether the pupils who are there are really the same as those marked down on the list of the Assistant Teacher (*Répétiteur*).

Art. CXLVIII. During the general inspections of the medical officers, they take care to send in successively all the pupils in due order and without any interruption.

Art. CXLIX. One of the Adjutants on duty superintends the delivery of provisions; his duty is to see that they are of the proper quality and quantity, and he reports his observations to the Captain on duty.

Art. CL. The Adjutants on duty receive the complaints preferred individually by the heads of each table during the meals, relative to the quantity or cooking of the dishes. If the complaints be well grounded, they request the steward to attend to it; and if the latter declines, they report the case to the Captain on duty.

Art. CLI. On the day before any holiday, the Adjutants note down in their daily report the number of pupils who will take their meals at the school. On the holiday they state in the report the number of pupils who are present at each meal.

Art. CLII. One of the Adjutants exercises a special superintendence over the Infirmary; whither he goes at least once a day, and oftener when necessary. He receives the requests and complaints of the sick pupils and of the Sisters, attends to the strict observance of the rules laid down for the place, and addresses, if requisite, an immediate report to the Captain on duty.

Art. CLIII. Independently of the daily report, the Adjutants immediately inform the Captains on duty of everything in any degree important, which may be of interest to good order and to the good behaviour of the pupils either in or out of the School.

Art. CLIV. In case of absence or illness, an Adjutant may be replaced by a Sub-Adjutant, who, in such cases, enjoys, in regard to the service and discipline, the same rights as the officer whose substitute he is.

Art CLV. The clauses of Articles 133, 134, 135, and 136 are applicable to the adjutants.

Chapter II.—*Medical Service.*

Section I.—*The Surgeon.*

Art. CLVI. The Surgeon superintends every branch of the medical service. He has the special direction of the Infirmary, where all that concerns the treatment and diet of the patients must be in accordance with his prescriptions.

Art. CLVII. The Surgeon visits the Infirmary every day, and oftener when the condition of the patients require it.

Art. CLVIII. Every day the Surgeon addresses a report to the Second in Command relative to the health of the pupils who are at the Infirmary, stating therein his requests and observations. He peruses the report drawn up by the Assistant-Surgeon on his daily service, and authenticates it by his own signature.

Art. CLIX. In cases of serious illness, the Surgeon may require the assistance of the Consulting Physician or Surgeon attached to the School. For that purpose, he applies to the Manager after giving due information thereof to the Second in Command.

Art. CLX. His attendance is due to all the civil and military officials of the establishment as well as to the pupils.

Art. CLXI. When it happens, in consequence of indisposition, that a student has not returned to the School at the end of a holiday, the Surgeon, upon orders from the Second in Command, visits the pupil to ascertain his real state, and immediately reports in writing the result of his observations.

Art. CLXII. Every Sunday the Surgeon attends, in the morning, at the Council of Order.

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Art. CLXIII. The Surgeon cannot absent himself from his daily service nor from the School at night, unless it be with the permission of the Second in Command, who informs the Commandant of the circumstance.

Art. CLXIV. At the beginning of the school-year, and whenever he receives orders to that purpose from the Second in Command, the Surgeon passes a general inspection of the students.

Section II.—*The Assistant Surgeon.*

Art. CLXV. The Assistant Surgeon assists and replaces, when required, the Surgeon in every branch of his service. In the Infirmary he is intrusted with the surgical operations, but can never undertake any without having consulted. He receives, and visits in the different parts of the barracks, such pupils as may wish to consult him, attends to their immediate wants, and sends them to the Infirmary.

Art. CLXVI. The Assistant Surgeon attends the Surgeon throughout his morning visit to the Infirmary. When the service requires it, he returns thither in the course of the day, at the request of the Surgeon or of the Officers on duty.

Art. CLXVII. When requisite, the Assistant Surgeon visits the pupils who are imprisoned or under arrest in the guard-room.

Art. CLXVIII. Every day he addresses to the Second in Command a report upon his services, which must be certified by the Surgeon.

Art. CLXIX. The Assistant Surgeon attends at the gymnastic exercises, and at the chemical manipulations.

Art. CLXX. In cases of sudden accidents, he may be called at all hours to give his assistance to such pupils as may stand in need of it.

Chapter III.—*Special Dispositions concerning the Military Staff of the School.*

Art. CLXXI. The Officers, Non-commissioned Officers, and Medical Officers, are subject to the general duties and discipline laid down in the Ordinance on the Internal Service of Military Corps.

Chapter IV.—*Educational Staff.*

Section I.—*The Director of the Studies.*

Art. CLXXIII. The Director of the Studies draws up the orders relative to the studies; but they are not in force until they have been signed by the Commandant, who communicates them to the Second in Command, that he may take all the measures required in respect of the police, discipline, and superintendence of the studies.

Art. CLXXIV. Before the courses open, and after consulting each Professor, he draws up the different programmes, lesson by lesson, taking care at the same time to conform to the general programmes approved of by the Minister of War.

Art. CLXXV. The Director of the Studies attends frequently at the lectures and experiments in the Laboratories, with the view of ascertaining whether the programmes are adhered to, and whether the general course of instruction is faithfully followed up. He attends as regularly as he can at the Examinations for Admission held in Paris, and at the examinations at the end of the year.

Art. CLXXVI. He superintends the interrogations which take place in the course of the year, attends frequently on those occasions, enforces punctuality on the part of the Professors and Assistant Teachers (*Répétiteurs*), and takes particular care that they award to each pupil the marks to which he is entitled. He collects these marks, and draws up the quarterly classification arising out of them. It is his business to form the lists in order of merit resulting from all the work of every description done by the pupils in the course of the year.

Art. CLXXVII. The Director of the Studies, after taking the opinion of the Professors, decides upon the establishments to be visited in the manner stated in the 88th Article. He regulates, as far as his duty is concerned, the details of the arrangements to be observed by the Examiners and by the pupils in the examinations for passing from one Division into the other, or for leaving the School. He is frequently present at those examinations.

When they are ended he compares the lists of the Examiners with those relative to the application and behaviour of the pupils during the year, and combines them so as to form a provisional classification for the use of the jury in drawing up the lists for promotion into the First Division, or for Departure from the School.

Art. CLXXVIII. The Director of the Studies selects the subjects of the written papers in the Examination for Admission to the School, bearing in view the observations on the subject made by the Boards of Instruction and of Improvement. He lays before the Com-

mandant the arrangements, within the sphere of his own duties, which he has to propose for the aforesaid examinations.

Art. CLXXIX. At the close of the School year he proposes to the Boards of Instruction and Improvement any alterations which he deems it advisable to introduce in the programmes of examination, of admission, or of instruction in the School.

Section II.—*The Examiners.*

Art. CLXXX. Each Examiner examines, as far as possible, the same number of pupils every day. The Examiners in Natural Philosophy, Chemistry, and Descriptive Geometry, examine, on the same day, all the pupils of each division who have gone through the examination in Analysis in one and the same single day of the preceding week. After the examinations of each day, they forward to the Captain on duty notice of the hour at which the examination will be resumed on the next day.

Art. CLXXXI. Three days after the close of the examinations, they send up their list of classification to the Commandant.

Art. CLXXXII. At the annual meeting of the Board of Improvement, each Examiner lays before the Board a report upon the examinations intrusted to his care.

Section III.—*The Professors.*

Art. CLXXXIII. The Professors are bound to adhere strictly to the programmes, in detail, as well as in general, and to the time-table.

Art. CLXXXIV. After each interrogation or competition, the Professors leave in the hands of the Captains on duty, a note containing the marks of merit which they have awarded to the pupils, and a brief summary of the subject given out for competition or interrogation.

Art. CLXXXV. The Professors who give out tasks in scientific or other drawing to be done, award a mark of merit for each of these exercises.

Art. CLXXXVI. They superintend the labours of the Assistant Teachers (*répétiteurs*) and Masters. They are present, when they deem it necessary, during the hours of study on their lectures.

Art. CLXXXVII. Each Professor or an Assistant Teacher in his place, accompanies the pupils in their visits to such establishments as are mentioned in the 88th Article, which are connected with his course of lectures.

Art. CLXXXVIII. When any serious circumstance prevents a Professor from giving or beginning his lesson at the appointed hour, he informs the Director of the Studies of the occurrence in time for the latter to arrange for the employment of that hour. He must likewise send similar information to the Director of the Studies, if illness obliges him to interrupt his lectures.

Section IV.—*The Assistant Teachers* (Répétiteurs) *and Masters.*

Art. CLXXXIX.—The Assistant Teachers follow the Professor's method of teaching, and conform to the instructions which they receive from the Professor, as well as from the Director of Studies. They attend the lectures in order to make themselves thoroughly acquainted with the subject of each lesson. The Assistant Teachers in chemistry are likewise charged with the preparations for the lectures, and attend in this respect to the instructions given them by the Professors. They superintend the manipulations undertaken by the pupils, and take care that the laboratories are kept in good order.

Art. CXC. The Master of Topographic Drawing, and the Master for Machinery Drawing follow the instructions given by the Director of the Studies, and forward to him direct accounts of the progress made by the pupils. The Masters in Figure and Landscape Drawing are under the direction of the Professor of Drawing. They guide the pupils through their labours, and give an account of the results to the Professors.

Art. CXCI. The Assistant Teachers and Masters award to the pupils marks of merit for the interrogations, manipulations, and exercises in scientific and other drawing.

Art. CXCII. The arrangements included in the 188th Article, are applicable to the Assistant Teachers and the drawing masters.

Chapter V.—*Administrative Staff.*

Section I.—*The Manager* (Administrateur).

Art. CXCIII. The Manager is the agent of the Board of Administration. He is charged, under the direction of the latter, with the execution of all regulations, minis-

APPENDIX B.

terial decisions, and deliberations of the Board, concerning the internal management of the School. He is responsible to the Board for every act which he may either order or authorize. He attends the meetings of the Board, where he performs the duties of Reporter, and entitled to a vote.

Art. CXCIV. The Manager has immediate control and superintendence over the Cashier, the Keepers of the furniture and scientific collections, over the clerks and other officials of this department. He also sees to the execution of the regulations laid down for the service of the library.

Art. CXCV. He prepares, and submits to the approval of the Board the quarterly and annual budgets, the periodical and contingent calls for monies, as well as the monthly statements drawn up for the payment of salaries and wages.

Art. CXCVI. He draws up the daily returns concerning the state of the establishment, the presence of the pupils, and of the clerks and others who are entitled to take their meals in the school.

Art. CXCVII. He lays before the Board of Administration the claims preferred by the different heads of services, and gives his own opinions on each case.

Art. CXCVIII. He takes all the preparatory measures for contracts.

Art. CXCIX. He presents to the Board an estimate of the probable expenses during the interval between one meeting and another.

Art. CC. He requires of the Architect an estimate of the operations which may be going on in the building, as well as an official report upon them when the works are finished.

Art. CCI. He is present at the delivery of all provisions, stores, articles of furniture, or others which he authorizes the Keepers of the furniture or of the scientific collections to take in.

Art. CCII. He directs every sort of distribution, guiding himself by the statements of the numbers, and by the tariffs approved by the Minister, and authorizes such distributions by the issue of tickets bearing his signature. He pays particular attention, as far as he may be concerned, to the service and direction of the Infirmary; ascertains that every article used or consumed is in accordance with the medical prescriptions, and the real number of patients, and verifies the statements relative to such articles of consumption.

Art. CCIII. Under the authorization of the Commandant, he allows the distribution of any small matter required by the different branches of the service, which could not be brought within the estimate laid before the Council.

Art. CCIV. He verifies and certifies the bills of tradesmen and contractors, as well as the books and registers used for receipts. He likewise verifies and certifies the accounts of all the agents, and all papers relative to outlays, submitting the whole to the approval of the Board.

Art. CCV. He inscribes on a special book, which is signed by the Military Under-Commissary (*sous-intendant*), and then delivers to the parties interested the different items of expense, in order that they may be paid by the Cashier.

Art. CCVI. At the end of each quarter he lays every paper and statement relative to the accounts before the Military Under-Commissary, whose duty it is to audit them.

Art. CCVII. In case of absence or serious illness, the Manager is succeeded by the Cashier in everything relative to the distribution and reception of articles, as well in the superintendence over the different clerks and agents. In regard to the verification of the accounts, he is replaced by a delegate of the Board of Administration.

Section II.—*The Cashier, Keeper of the Archives.*

Art. CCVIII.-CCXVII. These articles merely lay down rules for the proper direction of the accounts. The Cashier or Treasurer is secretary to the Board of Administration, and as Keeper of the archives has in his possession all the documents and papers relative to the organization and history of the School.

Section III.—*The Librarian.*

Art. CCXVIII. The Librarian is personally responsible for all the books and objects contained in the library. In case the library experiences any loss in consequence of an accident or unforeseen circumstances, he must inform the Board of Administration of the fact, which must likewise be certified by the Military Under-Commissary.

Art. CCXIX. Any work or object whatever which may be given by the Manager to the Librarian for the library, must be immediately inscribed in the catalogue.

Art. CCXX. The Librarian must never deliver any book or other object belonging to the library without requiring a receipt. The latter is valid only during three months, and must be renewed if the book or object is not returned by the borrower.

Section IV.—*The Keeper of Furniture and Stores.*

[The whole of this section relates to the duties of the agent who takes charge of the furniture of the establishment, and different articles of a similar character. The rules laid down are much the same as those enforced in every public institution of the kind, and in every country.]

Section V.—*On the Keepers of the Scientific Collections.*

Art. CCXXXII. The Keepers of the Scientific Collections are personally responsible for the preservation of the objects intrusted to their care They draw up, as far as they may be concerned therein, an inventory of all the objects, instruments, utensils, chemical products, &c., included in their collections.

Art. CCXXXIII. They are obliged to keep an account of the receipt and issues of all articles intrusted to their care. At the end of every quarter they draw up a balanced report of the state of their department, and they hand it over to the Keeper of the furniture.

Art. CCXXXIV. The loan of any articles required by the Professors or Assistant Teachers for the demonstrations of a lesson are not considered to be issues, but the Keepers take particular care that such objects are returned at the end of the lesson, and replaced in their proper division.

Art. CCXXXV. Whenever the pupils are admitted into the collections, the Keepers must attend in order to supply every necessary explanation.

Art. CCXXXVI. The Keeper of the Chemical Collections keeps an account of the different articles and substances required for the manipulations of the pupils. He forwards to the Manager the demands made by the Professors or Assistant Teachers for each manipulation.

Art. CCXXXVII. Before the manipulations begin, he proceeds to a general distribution among the students of both divisions, of such objects and utensils as they may stand in need of during the manipulations. He keeps an exact account of these deliveries in a special book which is certified to by the head-pupils belonging to each laboratory, who sign in the name of their fellow-students. When the course is closed, he inspects the condition of the above objects, notes down those which may be found wanting or deteriorated, which are carried over to the account of the students. This statement, signed both by the head-pupils of each laboratory and by the Captain on duty, is used for drawing up each individual account.

Art. CCXXXVIII. The Keeper of the Chemical Collections co-operates with the Assistant Teachers:—

1. To direct and superintend the manipulations of the pupils, and to award the marks of merit in this branch of instruction;
2. To supply them with such explanations as may be requisite before and during their visits to industrial establishments.

Art. CCXXXIX. The Keeper of the Apparatus for Natural Philosophy acts likewise as a preparatory assistant for that course of lectures. He must keep an exact account of such objects and substances as are used for the lessons.

Art. CCXL. The Keeper of the Models, independently of his special business, is intrusted with the delivery of paper, pens, ink, &c., required for the studies. Detailed accounts are required, and inspected by the Captain on duty.

Section VI.—*The Officials of the Administrative Department.*

Art. CCXLI. The distribution of the agents among the different branches of administration is regulated by the Commandant of the School.

Section VII.—*On the Military Officers attached to the School, and on the subordinate Officials.*

Art. CCXLII. The duties and service of the Sub-Adjutants and other Members of the Army attached to the School, as of the Subordinate official agents, are likewise determined by the Commandant of the School.

Title VI.—*Lodging.*

Art. CCXLIII. The following officers and functionaries are bound to live in the School—

The Commandant, the Second in Command, the Director of the Studies, the Captains, the Adjutants and Sub-Adjutants, the Manager, the Cashire, the Librarian, the Medical Officers, the Keeper, and all Clerks and subordinate officials, whose permanent presence at the School is deemed necessary by the Commandant.

APPENDIX B.

Art. CCXLIV. The distribution and allotment of the several lodgings is determined by the Board of Administration, with the help of the Under-Commissary. Their decisions are submitted to the approval of the Minister of War.

General Dispositions.

Art. CCLXV. To the Commandant of the School is instrusted, under his own responsibility, the carrying out of the present regulations. He determines by a supplementary instruction, such details and dispositions as may be necessary for their execution. He likewise adopts any measures which may be required by unforeseen circumstances, on condition of informing thereof the Minister in cases of importance.

Art. CCXLVI. All other dispositions and regulations for the Polytechnic School are, and remain, abrogated.

The President of the Council, Secretary of State for the War Department,
(Signed) MARSHAL THE DUKE OF DALMATIA.

APPENDIX C.

APPENDIX C.

TABLES SHOWING THE EMPLOYMENT OF

POLYTECHNIC SCHOOL.—FIRST

Table of the Distribution of Time during a Week in the Earlier

	5½	6	7	8	9	10	11	12	1	2	
Monday	Rise at half-past 5. Roll-call in the *Salles d'étude* at 6.		General Study (*étude libre*) in the *Salles d'étude.*	Breakfast.	Lecture in Descriptive Geometry.	Study on the Subjects of the Lecture.		Machine Drawing, Topographical Drawing.			Dinner.
Tuesday					Lecture in Analytical Mathematics.	Study on the Lecture.		Study and Graphical Work (*travaux graphiques*) connected with Descriptive Geometry.			
Wednesday					Exercises in Analytical Mathematics, Physical Science, or Chemistry, or General Study.			Lecture in Physical Science.	Study on the Lecture.		
Thursday					Lecture in Analytical Mathematics.	Study on the Lecture.		Work in the Laboratories, or Drawing.			
Friday					Lecture in Descriptive Geometry.	Study on the Lecture.		Study and Graphical Work connected with Descriptive Geometry.			
Saturday					Lecture in Analytical Mathematics.	Study on the Lecture.		Lecture in Chemistry.	Study on the Lecture.		
Sunday			General Study, or Military Exercise.		Inspection.			Leave of Absence till 10 p.m.			

SECOND YEAR'S

Table of Distribution of Time during a Week in the

	5½	6	7	8	9	10	11	12	1	2	
Monday	Rise at half-past 5. Roll-call in the *Salles d'étude* at 6.		General Study (*étude libre*) in the *Salles d'étude.*	Breakfast.	Lecture in Analytical Mathematics.	Study on the Lecture.		Work in the Laboratories, or Graphical Work.			Dinner.
Tuesday					Lecture in Mechanics and Machinery.	Study on the Lecture.		Graphical Work connected with Mechanics and Machinery, or with Architecture.			
Wednesday					General Study, or Exercises in Analysis, Mechanics, Physical Science, or Chemistry.			Lecture in Chemistry.	Study on the Lecture.		
Thursday					Lecture in Mechanics and Machinery.	Study on the Lecture.		Lecture in Architecture, and Construction.	Study and Graphical Work on the Subject of the Lecture.		
Friday					Lecture in Analytical Mathematics.	Study on the Lecture.		Graphical Work connected with Mechanics and Machinery, or with Architecture.			
Saturday					Lecture in Mechanics and Machinery.	Study on the Lecture.		Lecture on Physical Science.	Study on the Lecture.		
Sunday			General Study, or Military Exercise.		Inspection.			Leave of Absence till 10 p.m.			

APPENDIX C.

TIME IN THE POLYTECHNIC SCHOOL.

YEAR'S STUDIES.—TABLE I.
Part of the Session (from the 1st November to March).

3 4 5	6	7	8	9		
Recreation.	General Study and *Interrogations particulières* in Analysis, Descriptive Geometry, Physical Science, and Chemistry.		Landscape and Figure Drawing.			Monday.
Recreation.	Lecture in French Literature.		French Composition.			Tuesday.
	Leave of Absence till 10 p.m.					Wednesday.
Recreation.	General Study and *Interrogations particulières* in Analysis and Descriptive Geometry.		General Study and *Interrogations particulières* in Analysis, Physical Science, and Chemistry.			Thursday.
Recreation.	Lecture in German.	Study on the Lecture.	Landscape and Figure Drawing.			Friday.
Recreation.	General Study and *Interrogations Particulières* in Analysis and Descriptive Geometry.		Study and *Interrogations Particulières* in German.			Saturday.
				Supper at 9.	Roll-call in the Dormitories at 10 on Wednesday and Sunday; at half-past 9 on other days.	Sunday.

STUDIES.—TABLE II.
Earlier Part of the Session (November to March).

3 4 5	6	7	8	9		
Recreation.	German Study and *Interrogations particulières* in Analysis, and Mechanics and Machinery.		General Study and *Interrogations particulières* in Analysis, Physical Science, and Chemistry.			Monday.
Recreation.	Lecture in German.	Study on the Lecture.	Landscape and Figure Drawing.			Tuesday.
	Leave of Absence till 10 p.m.					Wednesday.
Recreation.	General Study and *Interrogations particulières* in Analysis, and Mechanics and Machinery.		Study and *Interrogations particulières* in German.			Thursday.
Recreation.	Lecture in French Literature.		French Composition.			Friday.
Recreation.	General Study and *Interrogations particulières* in Mechanics and Machinery, Physical Science, and Chemistry.		Landscape and Figure Drawing.			Saturday.
				Supper at 9.	Roll-call in the Dormitories at 10 on Wednesday and Sunday; at half-past 9 on other days.	Sunday.

TABLES SHOWING THE EMPLOYMENT OF TIME

POLYTECHNIC SCHOOL.—FIRST

Table of the Distribution of Time during a Week in the second

	$5\frac{1}{2}$	6	8	$8\frac{1}{2}$	10	11	12	1	2	
Monday	Rise at half-past 5. Roll-call in the *Salles d'étude* at 6.	General study (*étude libre*) in the *Salles d'étude.*	Breakfast.	Lecture in Geodesy.	Study on the subject of the Lecture.	Machine Drawing. Topographical Drawing.				Dinner.
Tuesday				Lecture in Mechanics and Machinery.	Study on the Lecture.	Graphical Work connected with Mechanics, and Machinery, or Geodesy.				
Wednesday				Exercises in Mechanics and Machinery, Geodesy, Physics, Chemistry, or general Study.		Lecture in Physical Science.	Study on the Lecture.			
Thursday				Lecture in Mechanics and Machinery.	Study on the Lecture.	Work in the Laboratories, or Drawing.				
Friday				Lecture in Geodesy.	Study on the Lecture.	Graphical Work connected with Mechanics and Machinery, or Geodesy.				
Saturday				Lecture in Mechanics and Machinery.	Study on the Lecture.	Lecture in Chemistry.	Study on the Lecture.			
Sunday		General Study, or Military Exercise.		Inspection.		Leave of Absence till 10 p.m.				

SECOND YEAR'S

Table of the Distribution of Time during a Week in the second

	$5\frac{1}{2}$	6	8	$8\frac{1}{2}$	9	10	11	12	1	2	
Monday	Rise at half-past 5. Roll-call in the *Salles d'étude* at 6.	General study (*étude libre*) in the *Salles d'étude.*	Breakfast.	Lecture in Geodesy.		Study on the Lecture.	Work in the Laboratories or Graphical Work.				Dinner.
Tuesday				Lecture in Military Art or Topography.		Study and Graphical Work on the Lecture.	Graphical Work connected with Topography, Geodesy, Architecture, or Military Art.				
Wednesday				Exercises in Geodesy, Physics, or Chemistry, or General Study.			Lecture on Chemistry.		Study on the Lecture.		
Thursday				Lecture in Military Art or Topography.		Study and Graphical Work on the Lecture.	Lecture on Architecture and Construction.		Study and Graphical Work on the Lecture.		
Friday				Lecture in Geodesy.		Study on the Lecture.	Graphical Work in Topography, Geodesy, Architecture, or Military Art.				
Saturday				Lecture in Military Art or Topography.		Study and Graphical Work on the Lecture.	Lecture in Physical Science.		Study on the Lecture.		
Sunday		General Study, or Military exercise.		Inspection.			Leave of Absence till 10 p.m.				

IN THE POLYTECHNIC SCHOOL.—*continued.*

YEAR'S STUDIES.—TABLE III.

portion of the Session (commencing on the 21st of March).

3 4 5	6	7	8	9	10
Recreation.	General Study and *Interrogations particulières in* Mechanics, Machinery, Geodesy, Physics, and Chemistry.		Landscape and Figure Drawing.	Supper at 9. Roll-call in the Dormitories at 10 on Wednesday and Sunday, on other days at 9½.	Monday.
Recreation.	Lecture in French Literature.	French Composition.			Tuesday.
Leave of absence till 10 p.m.					Wednesday.
Recreation.	General Study and *Interrogations particulière in Mechanics, Machinery, and Geodesy.*		General Study and *Interrogations particulières* in Geodesy, Physics and Chemistry.		Thursday.
Recreation.	Lecture on German.	Study on the Lecture.	Landscape and Figure Drawing.		Friday.
Recreation.	General Study and *Interrogations particulières* in Mechanics, Machinery, Geodesy, Physics, and Chemistry.		Study and *Interrogation particulières* in German.		Saturday
					Sunday.

STUDIES.—TABLE IV.

portion of the Session commencing on the 21st of March.

3 4 5	6	7	8	9	10
Recreation.	General Study and *Interrogations particulières* in Geodesy, Military Art, or Topography.		General Study and *Interrogations particulières* in Geodesy, Physics and Chemistry.	Supper at 9. Roll-call in the Dormitories on Sunday an Wednesday at 10; other days at 9½.	Monday.
Recreation.	Lecture in German.	Study on the Lecture.	Landscape and Figure Drawing.		Tuesday.
Leave of Absence till 10 p.m.					Wednesday.
Recreation.	General Study and *Interrogations particulières* in Geodesy, Chemistry, Military Art, or Topography.		Study and *Interrogations particulières* in German.		Thursday.
Recreation.	Lecture in French Literature.	French Composition.			Friday.
Recreation.	General Study and *Interrogations particulières* in Geodesy, Physics, Chemistry, Military Art, and Topography.		Landscape and Figure Drawing.		Saturday.
					Suuday.

TABLES SHOWING THE EMPLOYMENT OF

Polytechnic School.—First Year's
Table of the Distribution of Time, during a Week in the

	5½	6	8	8½	10	11	12	1	2	
Monday - -	Rise at half-past 5. Roll-call at 6 in the *Salles d'étude.*	General Study in the *Salle d'étude.*	Breakfast.	Lecture in Geodesy.	Study on the Lecture.	Machine and Topographical Drawing.				Dinner.
Tuesday - -				Lecture in Mechanics and Machinery.	Study on the Lecture.	Graphical Work connected with Mechanics and Machinery, or Geodesy.				
Wednesday -				Lecture in Geodesy.	Study on the Lecture.	Lecture in Physics.		Study on the Lecture.		
Thursday - -				Lecture in Mechanics and Machinery.	Study on the Lecture.	Work in the Laboratories, or Graphical Work.				
Friday - -				Lecture in Geodesy.	Study on the Lecture.	Graphical Work connected with Mechanics and Machinery, or Geodesy.				
Saturday - -				Exercises in Mechanics and Machinery, Geodesy, Physics and Chemistry, or General Study.		Lecture in Chemistry.		Study on the Lecture.		
Sunday - -		General Study, or Military Exercise.		Inspection.		Leave of Absence till 10 p.m.				

Second Year's
Table of the Distribution of Time During a Week in the

	5½	6	8	8½	10	11	12	1	2	
Monday - -	Rise at half-past 5. Roll-call at 6 in the *Salles d'étude.*	General Study in the *Salles d'étude.* (*Etude libre.*)	Breakfast.	Lecture in Geodesy.	Study on the Lecture.	Work in the Laboratories, or Graphical Work.				Dinner.
Tuesday - -				Lecture in Military Art, or Topography.	Study on the Lecture.	Graphical Work connected Topography, Geodesy, Architecture, and Military Art.				
Wednesday -				Lecture in Geodesy.	Study on the Lecture.	Lecture in Chemistry.		Study on the Lecture.		
Thursday - -				Lecture in Architecture and Construction.	Study on the Lecture.	Exercises in Geodesy, Physics or Chemistry, or General Study.				
Friday - -				Lecture in Geodesy.	Study on the Lecture.	Graphical Work connected with Topography, Geodesy, Architecture, or Military Art.				
Saturday - -				Lecture in Military Art, or Topography.	Study on the Lecture.	Lecture in Physical Science.		Study on the Lecture.		
Sunday - -		General Study, or Military Exercise.		Inspection.		Leave of Absence till 10 p.m.				

TIME IN THE POLYTECHNIC SCHOOL.—*continued.*

YEAR'S STUDIES.—TABLE V.
Third Portion of the Session, (commencing the 9th May).

5	6	7	8	8½	10	
Recreation.	Graphical Work, or General Study.	General Study and *Interrogations particulières* in Mechanics and Machinery, Geodesy, Physics, and Chemistry.		Supper at 9 on Wednesday and Sunday; on other days at half-past 8. Roll-call at 10 in the Dormitories on Wednesday and Sunday; on other days at half-past 9.		Monday.
	Lecture on French Literature.	French Composition.				Tuesday.
Leave of Absence till 10 p.m.						Wednesday.
Recreation.	General Study and *Interrogations particulières* In Mechanics and Machinery, and Geodesy.		In Geodesy, Physics, and Chemistry.			Thursday.
	Graphical Work or General Study.	Lecture in German.	Study on the Lecture.			Friday.
	General Study and *Interrogations particulières*, in Mechanics and Machinery, Geodesy, Physics, and Chemistry.		General Study, and *Interrogations particulières* in German.			Saturday.
						Sunday.

STUDIES.—TABLE VI.
Third Portion of the Session, commencing the 9th May.

5	6	7	8	8½	10	
Recreation.	General Study and *Interrogations particulières*, In Geodesy, Military Art, or Topography.		In Geodesy, Physics, and Chemistry.	Supper at 9 on Sunday and Wednesday; on other days at half-past 8. Roll-call at 10 on Sunday and Wednesday; on other days at half-past 9.		Monday.
	Graphical Work, or General Study.	Lecture in German.	Study on the Lecture.			Tuesday.
Leave of Absence till 10 p.m.						Wednesday.
Recreation.	General Study and *Interrogations particulières*, in Geodesy, Physics, Chemistry, Military Art, or Topography.		Study and *Interrogations particulières*, in German.			Thursday.
	Lecture in French Literature.	French Composition.				Friday.
	Graphical Work, or General Study.	General Study, and *Interrogations particulières* in Geodesy, Physics, Chemistry, Military Art, or Topography.				Saturday.
						Sunday.

APPENDIX D.

SHOWING THE ORDER IN WHICH THE VARIOUS BRANCHES OF THE PUBLIC SERVICE ARE SELECTED.

1. *Specimen List taken from the Calendar for the Year* 1843.

LIST IN ORDER OF MERIT OF THE PUPILS OF THE FIRST DIVISION RECOGNISED BY THE JURY AS ADMISSIBLE TO THE PUBLIC SERVICES, 25TH OCTOBER 1842.

1. MM. Rivot, Mines.
2. Villeneau, Ponts et Chaussées.
3. Phillips, Mines.
4. Schlemmer, Ponts et Chaussées.
5. Bonnet, ,,
6. Lancelin, ,,
7. Grenier, Mines.
8. Houpeur.
9. Aymard, Engineers.*
10. Durbach, Ponts et Chaussées
11. Carvalho, ,,
12. Degrand, ,,
13. Lambert, ,,
14. Colin, ,,
15. Fremaux, ,,
16. Pluyette, ,,
17. Vossier, ,,
18. Buffet, ,,
19. Lefébure, ,,
20. Mondrel, ,,
21. Savarin, ,,
22. Melaye, ,,
23. Myot, ,,
24. Vigouroux, ,,
25. Lermoyez, ,,
26. Peronne, ,,
27. De Beaucé, ,,
28. Sevenc, ,,
29. Coutant, ,,
30. Mondelet, ,,
31. Pugnet, ,,
32. De l'Epinay, ,,
33. Marini, ,,
34. Duponchel, ,,
35. Barrachin, ,,
36. Tainturier, ,,
37. Cabanus, ,,
38. Mangon, ,,
39. Lagere, ,,
40. Sollier, Naval Architects.
41. Boumard, ,,
42. De Fréminville, ,,
43. Parmentier, Engineers.
44. De Roussel, Naval Architects.
45. Delbalat, Geographical Corps.
46. Auxcousteaux, Powder & Saltpetre.
47. Le Do, Geographical Corps.
48. De Gourcuff, Tobacco.
49. Le Pennec, ,,
50. Debize, Staff Corps.
51. Barabé, Engineers.
52. Laville, Staff.
53. Saint Quentin, Engineers.
54. Lavalley, ,,
55. Odent, Navy.
56. Pérot, Engineers.
57. Dupont, ,,
58. Marchand, ,,
59. Roulet, Staff Corps.
60. Cayrol, Engineers.
61. MM. De Carbonel, Engineers.
62. Blanchet, ,,
63. Virgile, Marine Artillery.
64. Caillot, Engineers.
66. Poyeton, Artillery.
66. Dufetay, Navy.
67. Favier, Artillery.
68. Hérisson, ,,
69. Schneegans, ,,
70. Moulin, ,,
71. Vignotti, ,,
72. Girard, ,,
73. Fraissignes, ,,
74. Danse, ,,
75. Clouzet, ,,
76. Richard, ,,
77. Gounnelle, ,,
78. Archdéacon, ,,
79. Joubert, Navy.
80. Alquier, Artillery.
81. Rabot, ,,
82. Perot, ,,
83. Montluisant, ,,
84. Legardeur, ,,
85. Tessier, ,,
86. Huot, ,,
87. De Lauriston ,,
88. Pachon, ,,
89. Roger, ,,
90. Malleval, Marine Artillery.
91. Ladrange, Artillery.
92. Maucourant, ,,
93. Latour, ,,
94. Lagardère, ,,
95. Blanchard, ,,
96. Bial, ,,
97. Lestourgie, ,,
98. De Prin, ,,
99. Lion, ,,
100. Chanel, ,,
101. De Beaulaincourt, ,,
102. De Sailly, ,,
103. Renard, ,,
104. Dacquin, ,,
105. Corréard, Marine Artillery.
106. Gandil, Artillery.
107. Faure, ,,
108. Gras, ,,
109. Mercier, ,,
110. Toussaint, ,,
111. Pinczon-du-Sel, ,,
112. Levis, ,,
113. Pichot, ,,
114. Bernard, ,,
115. De Magallon, ,,
116. Boitel, ,,
117. Alexandre, Marine Artillery.
118. Colard, ,,
119. Du Corail, ,,

* M. Aymard appears, by M. Marielle's records, to have passed, in March 1843, into the Department of Roads and Bridges. It may be inferred also, from his age at entrance (21), that he was a pupil a mitted from the Army, and bound therefore to return to it, at least, as a matter of form. The Senior Military Student on the List is accordingly M. now Captain Parmentier, one of the Officers who took part in the capture of the Malakhoff.

APPENDIX D.

Order of Entering the several Public Services.

This, of course, is but the result of a single year.

A more exact idea as to the average manner in which the services are selected will be obtained by the following—

2. *Tables collected from the Calendars, showing the places in the Classified List of the Students appointed in a variety of Years to the several Services.*

1832.

Roads and bridges (*ponts et chaussées*)	1. 3. 4. 6. 7. 8. 9. 10.
Mines (*mines*)	2. 5.
Hydrographical corps (*ingénieurs hydrographes*)	14.
Artillery (*artillerie*)	13. 16. 17. 21. 26. 27. 31. 35. 36. 37. 38. 40. 41. 42 43. 44. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73.
Engineers (*génie militaire*)	11. 12. 15. 18. 19. 20. 22. 23. 24. 25. 28. 29. 30. 32. 33.
Navy (*marine*)	34. 39.
Marine artillery (*artillerie de mer*)	74.

1833. (In January of the year.)

Artillery (*artillerie*)	1. 4. 6. 10. 14. 15. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31.
Engineers (*génie militaire*)	2. 3. 5. 7. 8. 9. 11. 12. 13. 16. 17.

1833. (At the end of the year.)

Artillery (*artillerie*)	29. 30. 31. 36. 39. 41. 44. 47. 49. 51. 56. 57. 61. 65. 67. 68. 70. 72. 74. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 109. 110. 111. 112. 114. 115. 117. 118. 119. 120. 121.
Engineers (*génie militaire*)	26. 32. 34. 35. 37. 43. 45. 46. 48. 50. 53. 54. 58. 59. 60. 62. 63. 64. 66. 71. 73. 75. 76.
Marine artillery (*artillerie de mer*)	108. 113. 116.
Navy (*marine*)	38. 52. 69. 93.
Staff corps (*état major*)	16. 40. 42.
Naval architects (*génie maritime*)	25. 27.
Powder and saltpetre (*poudres et salpêtres*)	28.
Tobacco (*tabacs*)	8.
Hydrographical corps (*ingénieurs hydrographes*)	33.
Roads and bridges (*ponts et chaussées*)	2. 5. 7. 9. 10. 11. 12. 13. 14. 15. 17. 18. 19. 20. 21. 22. 23. 24.
Mines (*mines*)	1. 3. 4. 6.

1834.

Roads and bridges (*ponts et chaussees*)	1. 2. 3. 4. 5. 7. 9. 10. 11. 12. 14. 15. 16. 17 18. 19. 21. 22. 23. 24.
Mines (*mines*)	6. 8.
Artillery (*artillerie*)	13. 20. 27. 37. 39. 40. 51. 66. 61. 64. 71. 84. 85. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 101. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 147. 148.
Engineers (*génie militaire*)	28. 31. 33. 36. 38. 41. 42. 43. 44. 45. 46. 48. 49. 50. 52. 53. 54. 55. 57. 58. 59. 60. 62. 63. 65. 66. 67. 68. 70. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83.
Staff corps (*état major*)	29. 72. 102.
Marine artillery (*artillerie de mer*)	133. 149. 150.
Powder and saltpetre (*poudres et salpêtres*)	26.
Navy (*marine*)	34. 69. 100. 146.
Naval architects (*génie maritime*)	25. 30.
Tobacco (*tabacs*)	32.

1837.

Roads and bridges (*ponts et chaussées*)	2. 3. 5. 7. 10. 11. 12. 13. 14. 15. 16. 18. 20. 21. 22. 23. 24. 25. 26. 28. 29. 31. 32. 33. 34. 35. 36. 37. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49 50. 51. 53. 55. 56. 57. 58. 59. 61.
Mines (*mines*) - - -	1. 4. 6. 8. 9.
Artillery (*artillerie*) - -	65. 68. 83. 85. 86. 88. 89. 90. 91. 92. 94. 95. 96. 97. 98. 99. 101.
Engineers (*génie militaire*) -	17. 38. 52. 54. 62. 63. 66. 67. 69. 70. 72. 74. 76. 78. 79. 81. 82. 84.
Staff corps (*état major*) - -	30. 39. 64.
Navy (*marine*) - - -	73. 75. 80. 93.
Marine artillery (*artillerie de mer*)	105.
Engineers (*génie maritime*) -	19. 27.
Hydrographical corps (*ingénieurs hydrographes*) - - -	60.
Tobacco (*tabacs*) - - -	71.
Infantry (*infanterie*) - -	102. 103. 106. 107.

1838.

Roads and bridges (*ponts et chaussées*)	2. 5. 6. 7. 8. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 30. 31. 32. 33. 34. 36. 37. 39. 40. 41. 42. 45. 46. 47. 48. 49. 50. 52. 53. 54. 56. 57. 58. 59. 61. 62.
Mines (*mines*) - - -	1. 3. 4. 9. 10. 11. 12.
Artillery (*artillerie*) - -	43. 64. 67. 77. 81. 85. 94. 95. 96. 97. 98. 99. 101. 102. 103. 104. 105. 106. 107. 108. 109 110.
Engineers (*génie*) - - -	51. 66. 68. 69. 70. 71. 72. 73. 76. 79. 80. 82. 84. 86. 87. 88. 89. 91. 92. 93.
Staff corps (*état major*) -	35. 55. 78.
Navy (*marine*) - - -	44. 74. 83. 90. 100.
Marine artillery (*artillerie de marine*)	111. 112.
Naval architects (*génie maritime*) -	38. 60. 63.
Powder and saltpetre (*poudres et salpétres.*) - - -	29.
Tobacco (*tabacs*) - - -	65.

1839.

Roads and bridges (*ponts et chaussées*)	2. 6. 8. 11. 12. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 28. 29. 30. 31. 32. 33. 34. 35. 36. 38. 39. 40. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 57. 58.
Mines (*mines*) - - - -	1. 3. 4. 7. 9. 10. 13.
Artillery (*artillerie*) - - -	5. 41. 65. 67. 68. 77. 83. 86. 89. 93. 94. 96. 97. 98. 99. 100. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121.
Engineers (*génie militaire*) - -	55. 60. 62. 63. 64. 66. 69. 70. 72. 73. 76 78. 80. 81. 84. 85. 87. 88. 90. 91. 92.
Staff Corps (*état major*) - - -	43. 56. 71.
Navy (*marine*) - - - -	59. 82. 95. 101.
Naval architects (*génie maritime*) -	27. 37. 42. 61.
Tobacco (*tabacs*) - - - -	74. 75.

1842.

Roads and bridges (*ponts et chaussées*)	2. 4. 5. 6. 10. 11. 12. 13. 14. 15. 16. 17. 18 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39.
Mines (*mines*) - - - -	1. 3. 7. 8.
Artillery (*artillerie*) - - -	65. 66. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116.
Engineers (*génie militaire*) - -	9. 43. 51. 53. 54. 56. 57. 58. 60. 61. 62 64.
Staff corps (*état major*) - - -	50. 52. 59.
Navy (*marine*) - - - -	55. 67. 79.
Marine artillery (*artillerie de marine*)	63. 90. 105. 117. 118. 119.

APPENDIX D.

Order of Entering the several Public Services.

Hydrographical corps (*ingénieurs hydrographes*)	45. 47.
Tobacco (*tabacs*)	48. 49.
Powder and saltpetre (*Poudres et salpêtres*)	46.
Naval architects (*génie maritime*)	40. 41. 42. 44.

1843.

Roads and bridges (*ponts et chaussées*)	1. 5. 6. 7. 8. 9. 10. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28.
Mines (*mines*)	2. 3. 4.
Artillery (*artillerie*)	39. 41. 45. 52. 63. 81. 83. 85. 86. 87. 88. 89. 91. 92. 93. 95. 96. 97. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 144. 145. 146. 147.
Engineers (*génie militaire*)	31. 40. 48. 49. 50. 51. 53. 54. 55. 56. 57. 60. 62. 64. 65. 66. 67. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 80. 82. 84.
Staff corps (*état major*)	42. 58. 79.
Navy (*marine*)	46. 59. 61. 68.
Marine artillery (*artillerie de marine*)	90. 98. 143. 148. 149. 150. 151. 152. 153. 154. 155. 157.
Tobacco (*tabacs*)	37. 38.
Powder and saltpetre (*Poudres et salpêtres*).	43. 44. 47.
Naval architects (*génie maritime*)	11. 29. 30. 32. 33. 34. 35. 36.

1844.

Roads and bridges (*ponts et chaussées*)	1. 3. 4. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32.
Mines (*mines*)	2. 5. 6. 7.
Artillery (*artillerie*)	48. 59. 61. 62. 63. 66. 72. 76. 77. 78. 79. 80. 81. 82. 83. 85. 86. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109.
Engineers (*génie militaire*)	34. 47. 50. 53. 55. 57. 58. 64. 65. 67. 68. 69. 70. 73. 75.
Staff corps (*état major*)	49. 54. 60.
Marine artillery (*artillerie de marine*)	99. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119.
Naval architects (*génie maritime*)	35. 36. 37. 38. 39. 41. 42.
Tobacco (*tabacs*)	40.
Navy (*marine*)	56. 71. 74. 84.
Powders and saltpetre (*poudres et salpêtres*)	43 44.
Hydrographical corps (*ingénieurs hydrographes*)	33.
Telegraphs (*lignes télégraphes*)	45. 46. 51. 52.

1845.

Roads and bridges (*ponts et chaussées*)	1. 2. 3. 4. 8. 9. 11. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30.
Mines (*mines*)	5. 6. 7. 31. 32.
Artillery (*artillerie*)	52. 54. 57. 63 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 87. 88. 89. 90. 91. 92. 93. 94. 95. 97. 98. 99. 100. 102. 104. 105. 108. 109. 110. 111. 112. 113. 115. 116. 117. 118. 119. 120. 123. 125. 126. 127. 129. 131. 132.
Engineers (*génie militaire*)	12. 42. 44. 48. 50. 53. 55. 58. 59. 60. 61. 62. 64. 67. 68. 69. 70. 71. 72. 73.
Staff corps (*état major*)	49. 65. 66.
Navy (*Marine*)	46. 86. 96. 101. 103. 107. 114. 121. 122. 124.
Marine artillery (*artillerie de marine*)	135. 136. 139. 141. 142. 146. 147. 151. 153. 155. 157. 158.
Naval architects (*génie maritime*)	10. 35. 36. 38. 39. 41.

Hydrographical corps (*ingénieurs hydrographes*) - - - -	33.
Tobacco (*tabacs*) - - - -	37.
Telegraphs (*lignes télégraphiques*) -	45. 47. 51.
Powder and saltpetre (*poudres et salpêtres*) - - - - -	34. 43.
Cavalry (*cavalerie*) - - -	137. 143.
Infantry (*infanterie*) - - -	133. 140. 145. 148. 149.

3. *Similar Tables, for the last Nine Years, supplied by the Minister of War.*

[ÉTAT NUMÉRIQUE DES ÉLÈVES DE L'ECOLE POLYTECHNIQUE, CLASSÉS DANS LES DIVERS SERVICES PUBLICS, DEPUIS L'ANNÉE 1847.]

136 Pupils.

Roads and bridges (*ponts et chaussées*)	2. 3. 4. 10. 11. 12. 14. 15. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. (Total, 27 pupils.)
Mines (*mines*) - - - -	1. 5. 6. 7. 8. 13. 16. (Total, 7 pupils.)
Naval architects (*génie maritime*) -	37. 38. 40. 41. 43. (Total, 5 pupils.)
Hydrographical corps (*hydrographes*)	0.
Powder and saltpetre (*poudres et saltpêtres*) - - - - -	0.
Telegraphs (*télégraphes*) - - -	47. 49. 52. 57. (Total, 4 pupils.)
Tobacco (*tabacs*) - - - -	36. (Total, 1 pupil.)
Engineers (*génie militaire*) - -	9. 42. 44. 45. 46. 48. 50. 51. 56.....(Total, 26 pupils.)
Artillery (*artillerie de terre*) - -	39. 53.....(Total, 26 pupils.)
Staff corps (*état major*) - - -	54.

All the other numbers entered the Military Service.

1848.

130 Pupils.

Roads and bridges (*ponts et chaussées*)	7. 10. 11. 12. 13. 14. 16. 17. 18. 19. 20. 21. 23. 24. 25. 26. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 39. 40. 41.
Mines (*mines*) - - - - -	1. 2. 3. 4. 5. 6. 9.
Naval Architects (*génie maritime*) -	42. 44. 45. 47.
Hydrographical corps (*hydrographes*)	38.
Powder and saltpetre (*poudres et salpêtres*) - - - - - -	0.
Telegraphs (*télégraphes*) - -	48. 49. 50.
Tobacco (*tabacs*) - - - - -	0.
Engineers (*génie militaire*) - -	No. 51 and subsequent numbers. (Total, 26 pupils.)
Artillery (*artillerie de terre*) - -	8. .....(Total, 42 pupils.)
Staff corps (*état major*) - - -	15. 43. 46.

All the other numbers entered the Military Service.

1849.

120 Pupils.

Roads and bridges (*ponts et chaussées*)	1. 4. 6. 8. 9. 10. 11. 13. 14. 15. 16. 17. 18. 20. 21. 22. 23. 24. 26. 27. 28. 29. 30. 31.
Mines (*mines*) - - - - -	2. 3. 5. 7.
Naval architects (*génie maritime*) -	0.
Hydrographical corps (*hydrographie*)	32.
Powder and saltpetre (*poudres et salpêtres*) - - - - - -	0.
Telegraphs (*télégraphes*) - - -	39. 42. 43. 49.
Tobacco (*tabacs*) - - - - -	25.
Engineers (*génie militaire*) - -	19. 33. 36. 37. 38. 41. 45. 46. and the numbers following 49. (Total, 28 pupils.)
Artillery (*artillerie de terre*) - -	12. 35. 48. and the numbers following 49. (Total, 46 pupils.)
Staff corps (*état major*) - - -	34. 40. 44.

All the other numbers entered the Military Service.

APPENDIX D.

Order of Entering the several Public Services.

1850.

130 Pupils.

Roads and bridges (*ponts et chaussees*)	3. 4. 5. 6. 7. 8. 10. 12.
Mines (*mines*)	1. 2.
Naval architects (*génie maritime*)	0.
Hydrographical corps (*hydrographes*)	0.
Inspectors of agriculture and commerce (*inspecteurs de l'agriculture et du commerce*)	15. 18. 22. 25.
Telegraphs (*télégraphes*)	14. 27. 28. 30. 33. 34. 36. 41. 43. 45.
Tobacco (*tabacs*)	13.
Engineers (*génie militaire*)	19. 20. 21. 23. 24. 32. 35. 38. 40. 47. &c. (Total 21 pupils.)
Artillery (*artillerie de terre*)	17. 26. 29. 31. 39. 42. 44. 48. &c. (Total, 43 pupils.)
Staff corps (*état major*)	16. 53. 54.

All the other numbers entered the Military Service.

1851.

99 Pupils.

Roads and bridges (*ponts et chaussées*)	1. 3. 5. 9. 10. 12. 13. 14. 16.
Mines (*mines*)	2. 4. 6. 7. 8.
Naval architects (*génie maritime*)	11. 18.
Hydrographical corps (*hydrographes*)	21.
Powder and saltpetre (*poudres et salpêtres*)	0.
Telegraphs (*télégraphes*)	23. 26. 27. 28. 32. 33. 35. 37. 40. 41.
Tobacco (*tabacs*)	19. 22.
Engineers (*génie militaire*)	15. 17. 24. 25. 29. 36. 43. &c. (Total, 24 pupils.)
Artillery (*artillerie de terre*)	30. 31. 34. 39. &c. (Total, 30 pupils.)
Staff corps (*état major*)	20. 38. 42.

All the other numbers entered the Military Service.

1852.

88 Pupils.

Roads and bridges (*ponts et chaussées*)	3. 4. 5. 8. 9. 10. 11. 12. 13. 14.
Mines (*mines*)	1. 2. 6. 7.
Naval architects (*génie maritime*)	0.
Hydrographical corps (*hydrographes*)	16.
Powder and saltpetre (*poudres et salpêtres*)	0.
Telegraphs (*télégraphes*)	18. 19. 21. 25. 26. 27. 29. 30. 35. 40. 41. 42. 45. 46. 48.
Tobacco (*tabacs*)	15.
Engineers (*génie militaire*)	17. 22. 24. 28. 33. 34. 36. 37. 39. 43. 44. 50. 51. &c. (Total, 15 pupils.)
Artillery (*artillerie de terre*)	20. 31. 32. 38. 49. 52. &c. (Total, 36 pupils.)
Staff corps (*état major*)	23. 47. 53.

All the other numbers entered the Military Service.

1853.

88 Pupils.

Roads and bridges (*ponts et chaussées*)	1. 4. 5. 7. 8. 9. 10. 11. 14. 15.
Mines (*mines*)	3. 6. 12. 13. 16. 17.
Naval architects (*génie maritime*)	2. 18. 20. 22. 23.
Hydrographical corps (*hydrographes*)	19. 25.
Powder and saltpetre (*poudres et salpêtres*)	28. 39.
Telegraphs (*télégraphes*)	29. 30. 33. 36. 43. 46. 48. 50. 52. 56.
Tobacco (*tabacs*)	26. 27.
Engineers (*génie militaire*)	31. 32. 34. 40. 41. 42. 45. 47. 51. 53. 55. &c. (Total, 16 Pupils).
Artillery (*artillerie de terre*)	24. 35. 37. 44. 49. 54. &c. (Total, 29 Pupils.)
Staff corps (*état major*)	21. 35. 38.

All the other numbers entered the Military Service

APPENDIX D.

Order of Entering the several Public Services.

1854.

92 Pupils.

Roads and bridges (*ponts et chaussées*)	1. 4. 6. 7. 8.
Mines (*mines*) - - - -	3. 5.
Naval architects (*génie maritime*) -	10. 11. 14. 15. 16.
Hydrographical corps (*hydrographes*)	0.
Powder and saltpetre (*poudres et salpétres*).	0.
Telegraphs (*télégraphes*) - - -	0.
Tobacco (*tabacs*) - - - -	0.
Engineers (*génie militaire*) - -	13. 17. 20. 21. 22. 23. . . .
Artillery (*artillerie de terre*) - -	2. 12. 18. 19. . . . .
Staff corps (*état major*) - - -	25. 27. 35.

All the other numbers entered the Military Service.

1855.

94 Pupils.

Roads and bridges (*ponts et chaussées*)	1. 3. 5. 7. 10. 11. 14. 15.
Mines (*mines*) - - - -	2. 4. 8. 12. 13.
Naval architects (*génie maritime*) -	9. 16. 17. 18. 19. 21.
Military marine (*marine militaire*) -	6.
Hydrographical corps (*hydrographes*)	0.
Powder and saltpetre (*poudres et salpétres*) - - - - -	0.
Telegraphs (*telegraphes*) - - -	0.
Tobacco (*tabacs*) - - - -	0.
Engineers (*génie militaire*) - -	23. 24. 25. 27. 28. 29. 31. 34. 35. 37.
Artillery (*artillerie de terre*) - -	20. 32. 33. 36. . . . .
Staff corps (*état major*) - - -	26. 30.
Naval commissariat (*commissariat de marine*) - - - -	22. 38.

All the other numbers entered the Military Service.

APPENDIX E.

POLYTECHNIC SCHOOL.

RETURN, showing the CREDITS obtained in the Five Principal Subjects of STUDY, by the first Five and last Five of the STUDENTS of the POLYTECHNIC SCHOOL, who respectively selected the "PONTS ET CHAUSSEES, ARTILLERIE DE TERRE, and GENIE MILITAIRE," together with those of the Ten last on the CLASSIFIED LIST of MERIT, for the Years 1852, 1853, 1854.

DESIGNATION OF SERVICES.		Maximum Credits.	1852.										1853.									
			1620.		1680.		1360.		1360		720		1620.		1840.		1360.		1360.		720	
			ANALYSIS.		MECHANICS.		PHYSICS.		CHEMISTRY.		GEOMETRY, OR STEREOTOMY, OR GEODESY.		ANALYSIS.		MECHANICS.		PHYSICS.		CHEMISTRY.		GEOMETRY, OR STEREOTOMY, OR GEODESY.	
	Number.		Co-efficient of Influence.	Number of Credits obtained.	Co-efficient of Influence.	Number of Credits obtained.	Co-efficient of Influence.	Number of Marks obtained.	Co-efficient of Influence.	Number of Marks obtained.	Co-efficient of Influence.	Number of Marks obtained.	Co-efficient of Influence.	Number of Credits obtained.	Co-efficient of Influence.	Number of Credits obtained.	Co-efficient of Influence.	Number of Marks obtained.	Co-efficient of Influence.	Number of Marks obtained.	Co-efficient of Influence.	Number of Marks obtained.
PONTS ET CHAUSSEES.	The five first. 1	81	1357·36	*84	1418·57	68	1208·98	68	1192·92	36	641·14	81	1501	92	1082	68	1236	68	1162	36	628
	2	„	1369·02	„	1470·52	„	1103·04	„	1064·04	„	619·02	„	1448	„	1614	„	1234	„	917	„	644
	3	„	1390·87	„	1489·59	„	1194·83	„	1038·02	„	674·34	„	1395	„	1562	„	1104	„	1147	„	603
	4	„	1391·43	„	1399·53	„	1153·69	„	1129·83	„	607·16	„	1278	„	1541	„	1188	„	1210	„	573
	5	„	1183·94	„	1422·43	„	1093·27	„	1132·01	„	580·33	„	1290	„	1569	„	1160	„	1044	„	605
	The five last. 1	„	1168·98	„	1279·31	„	1178·14	„	1122·23	„	640·98	„	1306	„	1514	„	1149	„	1133	„	609
	2	„	1177·53	„	1383·51	„	1145·69	„	1121·73	„	622·52	„	1281	„	1508	„	1346	„	1150	„	509
	3	„	1366·82	„	1353·16	„	1135·89	„	1088·69	„	618·	„	1249	„	1389	„	1025	„	1030	„	627
	4	„	1301·28	„	1162·16	„	1048·98	„	2039·31	„	646·60	„	1191	„	1412	„	1133	„	1094	„	622
	5	„	1183·45	„	1389·96	„	1094·86	„	1105·28	„	617·97	„	1257	„	1554	„	1041	„	1027	„	579
GENIE MILITAIRE.	The five first. 1	„	1342·20	„	1272·60	„	982·15	„	1056·83	„	573·98	„	987	„	1365	„	798	„	996	„	581
	2	„	1277·22	„	1252·31	„	1045·04	„	1016·50	„	580·60	„	1066	„	1399	„	988	„	995	„	568
	3	„	1269·98	„	1334·01	„	1041·08	„	940·06	„	503·67	„	1237	„	1303	„	820	„	865	„	545
	4	„	1183·	„	1068·	„	950	„	1021·	„	544·	„	1109	„	1284	„	978	„	862	„	457
	5	„	1200·	„	1271·	„	77	„	536·	„	631·	„	1017	„	1418	„	869	„	803	„	520

DESIGNATION OF SERVICES.		1854.									
		1620.		1660.		1400.		1360.		1400.	
		ANALYSIS.		MECHANICS.		PHYSICS.		CHEMISTRY.		GEOMETRY, OR STEREOTOMY, OR GEODESY.	
	Number.	Co-efficient of Influence.	Number of Credits obtained.	Co-efficient of Influence.	Number of Credits obtained.	Co-efficient of Influence.	Number of Marks obtained.	Co-efficient of Influence.	Number of Marks obtained.	Co-efficient of Influence.	Number of Marks obtained.
PONTS ET CHAUSSEES.	The five first. 1	81	1234	83	1295	70	1211	68	1191	70	1289
	2	„	1199	„	1358	„	1234	„	1211	„	1234
	3	„	1434	„	1533	„	1294	„	1228	„	1310
	4	„	1326	„	1256	„	1170	„	1197	„	1301
	5	„	1301	„	1398	„	1237	„	1132	„	1247
	The five last. 1	„	1230	„	1328	„	1028	„	1037	„	1157
	2	„	1314	„	1392	„	1208	„	1067	„	1161
	3	„	1271	„	1392	„	1124	„	973	„	1225
	4	„	1425	„	1416	„	1173	„	1113	„	1057
	5	„	1237	„	1348	„	1136	„	1006	„	1086
GENIE MILITAIRE.	The five first. 1	„	1318	„	1246	„	1112	„	894	„	1123
	2	„	1164	„	1238	„	1003	„	1176	„	1079
	3	„	1238	„	1268	„	1088	„	1016	„	1143
	4	„	999	„	1178	„	1111	„	1015	„	1125
	5	„	1020	„	1228	„	1058	„	1093	„	1021

GENIE MILITAIRE.	The five last.	1	„	1105·	„	1100·	„	813	„	876·	„	595·	„	935	„	1230	„	941	„	945	„	472	„	1014	„	1120	„	1040	„	824	„	972
		2	„	1069·	„	1250·	„	952	„	842·	„	566·	„	953	„	1254	„	845	„	846	„	564	„	1249	„	1235	„	1019	„	992	„	1012
		3	„	1092·	„	1016·	„	928	„	1052·	„	445·	„	1033	„	1188	„	856	„	793	„	493	„	909	„	1220	„	993	„	1071	„	924
		4	„	1152·	„	1099·	„	1003	„	969·	„	400·	„	1127	„	1170	„	733	„	739	„	402	„	1053	„	1131	„	1025	„	1044	„	879
		5	„	1093·	„	1143·	„	968	„	682·	„	570·	„	934	„	1071	„	868	„	956	„	513	„	990	„	1100	„	903	„	778	„	1132
	The five first.	1	„	1170·	„	1369	„	1033	„	1107·	„	459·	„	1025	„	1446	„	1064	„	1102	„	500	„	1375	„	1432	„	1260	„	1170	„	1193
		2	„	1167·	„	1196·	„	1054	„	992·	„	598·	„	921	„	1365	„	863	„	981	„	510	„	1246	„	1419	„	1078	„	1075	„	1038
		3	„	1060·	„	1227·	„	954	„	1065·	„	352·	„	922	„	1243	„	935	„	997	„	577	„	1215	„	1375	„	1072	„	952	„	1119
		4	„	921·	„	1181·	„	1002	„	760·	„	555·	„	1108	„	1282	„	1023	„	714	„	515	„	1237	„	1224	„	1088	„	1010	„	1103
		5	„	916·	„	1292·	„	905	„	834·	„	552·	„	990	„	1293	„	848	„	879	„	507	„	1258	„	1325	„	1067	„	937	„	1003
ARTILLERIE DE TERRE	The five last.	1	„	1091·	„	1138·	„	863	„	680·	„	391·	„	845	„	1133	„	581	„	612	„	468	„	1100	„	827	„	762	„	779	„	817
		2	„	974·	„	836·	„	947	„	684·	„	377·	„	836	„	998	„	829	„	788	„	470	„	897	„	791	„	740	„	902	„	855
		3	„	1001·	„	947·	„	645	„	676·	„	450·	„	947	„	986	„	790	„	706	„	435	„	892	„	984	„	606	„	743	„	691
		4	„	980·	„	909·	„	753	„	815·	„	399·	„	687	„	957	„	695	„	594	„	525	„	771	„	728	„	814	„	768	„	868
		5	„	265·	„	1037·	„	672	„	594·	„	330·	„	772	„	1023	„	784	„	663	„	411	„	859	„	761	„	840	„	747	„	797
	The last ten on the List of Merit.	1	„	1000·	„	1030·	„	836	„	709·	„	475·	„	766	„	1076	„	757	„	821	„	507	„	859	„	761	„	840	„	747	„	797
		2	„	995·	„	1097·	„	890	„	719·	„	378·	„	1017	„	1062	„	853	„	772	„	379	„	986	„	1040	„	634	„	780	„	801
		3	„	861·	„	910·	„	820	„	1052·	„	438·	„	860	„	1118	„	726	„	510	„	506	„	941	„	925	„	842	„	854	„	749
		4	„	1091·	„	1138·	„	863	„	680·	„	391·	„	769	„	951	„	735	„	842	„	482	„	771	„	728	„	814	„	768	„	868
		5	„	974·	„	836·	„	947	„	684·	„	377·	„	845	„	1133	„	581	„	612	„	468	„	859	„	761	„	840	„	747	„	797
		6	„	1001·	„	947·	„	645	„	676·	„	450·	„	836	„	998	„	829	„	788	„	470	„	789	„	942	„	704	„	699	„	734
		7	„	980·	„	909·	„	753	„	815·	„	399·	„	947	„	986	„	790	„	706	„	435	„	909	„	951	„	632	„	781	„	677
		8	„	933·	„	779·	„	775	„	823·	„	317·	„	1018	„	982	„	878	„	757	„	401	„	821	„	687	„	592	„	640	„	918
		9	„	965·	„	1037·	„	672	„	594·	„	330·	„	687	„	957	„	695	„	594	„	525	„	938	„	931	„	757	„	695	„	863
		10	„	750·	„	774·	„	863	„	910·	„	393·	„	772	„	1023	„	784	„	663	„	411	„	617	„	659	„	664	„	806	„	821

* The "*mean value*" of the credit obtained by each student in each branch of study is obtained by dividing the number of credits obtained by the "*co-efficient of influence*" for the particular study.

APPENDIX F.

Analysis, First Year.

APPENDIX F.

Programmes of the Principal Courses of Internal Instruction of the Imperial Polytechnic School during the Two Years of Study.

1. ANALYSIS, FIRST YEAR.

Differential Calculus.

Lessons 1—9.

Derivatives and Differentials of Functions of a Single Variable.

Indication of the original problems which led geometers to the discovery of the infinitesimal calculus.

Use of infinitesimals; condition, subject to which, two infinitely small quantities may be substituted for one another. Indication in simple cases of the advantage of such substitution.

On the different orders of infinitely small quantities. Infinitely small quantities of a certain order may be neglected in respect of those of an inferior order. The infinitely small increment of a function is in general of the same order as the corresponding increment of the variable, that is to say, their ratio has a finite limit.

Definitions of the derivative and differential of a function of a single variable. Tangents and normals to plane curves, whose equation in linear or polar co-ordinates is given.

A function is increasing or decreasing, according as its derivative is positive or negative. If the derivative is zero for all values of the variable, the function is constant. Concavity and convexity of curves; points of inflexion.

Principle of function of functions. Differentiation of inverse functions.

Differentials of the sums, products, quotients, and powers of functions, whose differentials are known. General theorem for the differentiation of functions composed of several functions.

Differentials of exponential and logarithmic functions.

Differentials of direct and inverse circular functions.

Differentiation of implicit functions.

Tangents to curves of double curvature. Normal plane.

Differential of the area and arc of a plane curve, in terms of rectilinear and polar co-ordinates.

Differential of the arc of a curve of double curvature.

Applications to the cycloid, the spiral of Archimedes, the logarithmic spiral, the curve whose normal, sub-normal, or tangent, is constant; the curve whose normal passes through a fixed point; the curve whose arc is proportional to the angle which it subtends at a given point.

Derivatives and differentials of different orders of functions of one variable. Notation adopted.

Remarks upon the singular points of plane curves.

Lessons 10—13.

Derivatives and Differentials of Functions of Several Variables.

Partial derivatives and differentials of functions of several variables. The order in which two or any number of differentiations is effected does not influence the result.

Total differentials. Symbolical formula for representing the total differential of the n^{th} order of a function of several independent variables.

Total differentials of different orders of a function; several dependent variables. Case where these variables are linear functions of the independent variables.

The infinitesimal increment of a function of several variables may in general be regarded as a linear function of the increments assigned to the variables. Exceptional cases.

Tangent and normal planes to curved surfaces.

Lessons 14—18.

Analytical Applications of the Differential Calculus.

Development of F $(x + h)$, according to ascending powers of h. Limits within which the remainder is confined on stopping at any assigned power of h.

Development of F (x), according to powers of x or $x—a$; a being a quantity arbitrarily assumed. Application to the functions sin (x), cos x, a^x, $(1 + x)^m$ and log. $(1 + x)$. Numerical applications. Representation of cos x and sin x by imaginary exponential quantities.

Developments of $\cos^m x$ and $\sin^m x$ in terms of sines and curves of multiples of x.

Development of F $(x + h, y + k)$, according to powers of h and k. Development of

F (x, y) according to powers of x and y. Expression for the remainder. Theorem on homogeneous functions.

Maxima and minima of functions of a single variable; of functions of several variables, whether independent or connected by given equations. How to discriminate between maxima and minima values in the case of one and two independent variables.

True values of functions, which upon a particular supposition assume one or another of the forms

$$\frac{0}{0},\ \frac{\infty}{\infty},\ \infty \times 0,\ 0^0,\ 4^\infty$$

Lessons 19—23.

Geometrical Applications. Curvature of Plane Curves.

Definition of the curvature of a plane curve at any point. Circle of curvature. Center of curvature. This center is the point where two infinitely near normals meet.

Radius of curvature with rectilinear and polar co-ordinates. Change of the independent variable.

Contacts of different orders of plane curves. Osculating curves of a given kind. Osculating straight line. Osculating circle. It is identical with the circle of curvature.

Application of the method of infinitesimals to the determination of the radius of curvature of certain curves geometrically defined. Ellipse, cycloid, epicycloid, &c.

Evolutes of plane curves. Value of the arc of the evolute. Equation to the involute of a curve. Application to the circle. Evolutes considered as envelops. On envelops in general. Application to caustics.

Lessons 14—17.

Geometrical Applications continued. Curvature of Lines of Double Curvature and of Surfaces.

Osculating plane of a curve of double curvature. It may be considered as passing through three points infinitely near to one another, or as drawn through a tangent parallel to the tangent infinitely near to the former. Center and radius of curvature of a curve of double curvature. Osculating circle. Application to the helix.

Radii of curvature of normal sections of a surface. Maximum and minimum radii Relations between these and that of any section, normal or oblique.

Use of the indicatrix for the demonstration of the preceding results. Conjugate tangents. Definition of the lines of curvature. Lines of curvature of certain simple surfaces. Surface of revolution. Developable surfaces. Differential equation of lines of curvature in general.

Lesson 28.

Cylindrical, Conical, Conoidal surfaces, and Surfaces of Revolution.

Equations of these surfaces in finite terms. Differential equations of the same deduced from their characteristic geometrical properties.

INTEGRAL CALCULUS.

Lessons 29—34.

Integration of Functions of a Single Variable.

Object of the integral calculus. There always exists a function which has a given function for its derivative.

Indefinite integrals. Definite integrals. Notation. Integration by separation, by substitution, by parts.

Integration of rational differentials, integer or fractional, in the several cases which may present themselves. Integration of the algebraical differentials, which contain a radical of the second degree of the form $\sqrt{c+bx+cx^2}$. Different transformations which render the differential rational. Reduction of the radical to one of the forms

$$\sqrt{x^2+a^2},\ \sqrt{a^2-x^2},\ \sqrt{x^2-a^2}.$$

Integration of the algebraical differentials which contain two radicals of the form

$$\sqrt{a+x},\ \sqrt{b+x},$$

or any number of monomials affected with fractional indices. Application to the expressions

$$\frac{x^m dx}{\sqrt{1-x^2}},\ \frac{dx}{x^m\sqrt{1-x^2}},\ \frac{x^m dx}{\sqrt{ax-x}}.$$

Integration of the differentials

$$\mathrm{F}(\log x)\frac{dx}{x},\ \mathrm{F}\sin^{-1}x\frac{dx}{\sqrt{1-x^2}},\ x\ (\log x)^n\,dx,\ x^m e^{ax}\,dx,\ (\sin^{-1}x)^m\,dx.$$

Integration of the differentials $e^{ax}\sin bx dx$ and $e^{ax}\cos bx dx$.

Integration of $(\sin x)^m.(\cos x)^n\,dx$.

Integration by series. Application to the expression $\frac{dx}{\sqrt{ax-x^2}\sqrt{1-bx}}$.

APPENDIX F.

Analysis, First Year.

Application of integration by series to the development of functions, the development of whose derivatives is given; $\tan^{-1}x$, $\sin^{-1}x$, $\log(1+x)$.

Lessons 35—38.

Geometrical Applications.

Quadrature of certain curves. Circle, hyperbola, cycloid, logarithmic spiral, &c.

Rectification of curves by rectilinear or polar co-ordinates. Examples. Numerical applications.

Cubic content of solids of revolution. Quadrature of their surfaces.

Cubic content of solids in general, with rectilinear or polar co-ordinates. Numerical applications.

Quadrature of any curved surfaces expressed by rectangular co-ordinates. Application to the sphere.

Lessons 39—42.

Mechanical Applications.

General formula for the determination of the center of gravity of solids, curved or plane surfaces, and arcs of curves. Various applications.

Guldin's theorem.

Volume of the truncated cylinder.

General formula which represent the components of the attraction of a body upon a material point, upon the supposition that the action upon each element varies inversely as the square of the distance. Attraction of a spherical shell on an external or internal point.

Definition of moments of inertia. How to calculate the moment of inertia of a body in relation to a straight line, when the moment in relation to a parallel straight line is known. How to represent the moments of inertia of a body relative to the straight lines which pass through a given point by means of the radii vectores of an ellipsoid. What is meant by the *principal axes of inertia.*

Determination of the principal moments of inertia of certain homogeneous bodies, sphere, ellipsoid, prism, &c.

Lessons 43—45.

Calculus of Differences.

Calculation of differences of different orders of a function of one variable by means of values of the function corresponding to equidistant values of the variable.

Expression for any one of the values of the function by means of the first, and its differences. Numerical applications; construction of tables representing a function whose differences beyond a certain order may be neglected. Application to the theory of interpolation. Formulæ for approximation by quadratures. Numerical exercises relative to the area of the equilateral hyperbola or the calculation of a logarithm.

Lessons 46—48.

Revision.

General reflexions on the subjects contained in the preceding course.

SECOND YEAR.

Continuation of the Integral Calculus.

Lessons 1, 2.

Definite Integrals.

Differentiation of a definite integral with respect to a parameter in it, which is made to vary. Geometrical demonstration of the formula. Integration under the sign of integration. Application to the determination of certain definite integrals.

Determination of the integrals $\int^{\infty} \frac{\sin ax}{x}\,dx$, and $\int^{\infty} \frac{\cos bx \sin ax}{x}\,dx$, between the limits o and x. Remarkable discontinuity which these integrals present.

Determination of $\int^{\infty} e^{-x^2}\,dx$ and $\int^{\infty} e^{-x^2} \cos mx\,dx$ between the limits 0 and ∞.

Lesson 3.

Integration of Differentials containing several Variables.

Condition that an expression of the form $M\,dx + N\,dy$ in which M and N are given functions of x and y may be an exact differential of two independent variables x and y. When this condition is satisfied, to find the function.

Extension of this theory to the case of three variables.

Lesson 4—6.

Integration of Differential Equations of the First Order.

Differential equations of the first order with two variables. Problem in geometry to which these equations correspond. What is meant by their integral. This integral always exists, and its expression contains an arbitary constant.

Integration of the equation $M\,dx + N\,dy = 0$ when its first member is an exact differential. Whatever the functions M and N may be there always exists a factor μ, such that $\mu\,(M\,dx + N\,dy)$ is an exact differential.

Integration of homogeneous equations. Their general integral represents a system of similar curves. The equation $(a + b\,x + c\,y)\,dx + (a' + b'\,x + c'\,y)\,dy = c$, may be rendered homogeneous. Particular case where the method fails. How the integration may be effected in such case.

Integration of the linear equation of the first order $\frac{dy}{dx} + P\,y = Q$, where P & Q denote functions of x. Examples.

Remarks on the integration of equations of the first order which contain a higher power than the first of $\frac{dy}{dx}$. Case in which it may be resolved in respect of $\frac{dy}{dx}$. Case in which it may be resolved in respect of x or y.

Integrations of the equation $y = x\,\frac{dy}{dx} + \phi\left(\frac{dy}{dx}\right)$. Its general integral represents a system of straight lines. A particular solution represents the envelop of this system.

Solution of various problems in geometry which lead to differential equations of the first order.

Lessons 7—8.

Integration of Differential Equations of Orders superior to the First.

The general integral of an equation of the m order contains m arbitrary constants. (*The demonstration is made to depend on the consideration of infinitely small quantities.*)

Integration of the equation $\frac{d^m y}{dx^m} = \phi\,(x)$.

Integration of the equation $\frac{d^2 y}{dx^2} = \phi\left(y, \frac{dy}{dx}\right)$.

How this is reduced to an equation of the first order. Solution of various problems in geometry which conduct to differential equations of the second order.

Lessons 9—10.

On Linear Equations.

When a linear equation of the m^{th} order contains no term independent of the unknown function and its derivatives, the sum of any number whatever of particular integrals multiplied by arbitrary constants is also an integral. From this the conclusion is drawn that the general integral of this equation is deducible from the knowledge of m particular integrals.

Application to linear equations with constant co-efficients. Their integration is made to depend on the resolution of an algebraical equation. Case where this equation has imaginary roots. Case where it has equal roots. The general integral of a linear equation of any order, which contains a term independent of the function, may be reduced by the aid of quadratures to the integration of the same equation with this term omitted.

Lesson 11.

Simultaneous Equations.

General considerations on the integration of simultaneous equations. It may be made to depend on the integrations of a single differential equation. Integration of a system of two simultaneous linear equations of the first order.

Lesson 12.

Integrations of Equations by Series.

Development of the unknown function of the variable x according to the powers of $x-a$. In certain cases only a particular integral is obtained. If the equation is linear, the general integral may be deduced from it by the variation of constants.

Lessons 13—16.

Partial Differential Equations.

Elimination of the arbitrary functions which enter into an equation by means of partial derivatives. Integration of an equation of partial differences with two independent variables, in the case where it is linear in respect to the derivatives of the unknown function. The general integral contains an arbitrary function.

APPENDIX F.

Analysis, Second Year.

Indication of the geometrical problem, of which the partial differential equation expresses analytically the enunciation. Integration of the partial differential equations to cylindrical, conical, conoidal surfaces, and surfaces of revolution. Determination of the arbitrary functions.

Integration of the equation $\frac{d^2u}{dy^2} = a^2\frac{d^2u}{dx^2}$. The general integral contains two arbitrary functions. Determination of these functions.

Lessons 17—23.

Applications to Mechanics.

Equation to the catenary.

Vertical motion of a heavy particle, taking into account the variation of gravity according to the distance from the center of the earth. Vertical motion of a heavy point in a resisting medium, the resistance being supposed proportional to the square of the velocity.

Motion of a heavy point compelled to remain in a circle or cycloid. Simple pendulum. Indication of the analytical problem to which we are led in investigating the motion of a free point.

Motion of projectiles in a vacuum. Calculation of the longitudinal and transversal vibrations of cords. Longitudinal vibrations of elastic rods. Vibration of gases in cylindrical tubes.

Lessons 24—26.

Applications to Astronomy.

Calculation of the force which attracts the planets, deduced from Kepler's laws. Numerical data of the question.

Calculation of the relative motion of two points attracting one another, according to the inverse square of the distance.

Determination of the masses of the earth and of the planets accompanied by satellites. Numerical applications.

Lessons 27—30.

Elements of the calculus of probabilities and social arithmetic.

General principles of the calculus of chances. Simple probability, compound probability, partial probability, total probability. Repeated trials. Enunciation of Bernouilli's theorem (without proof).

Mathematical expectation. Applications to various cases, and especially to lotteries.

Tables of population and mortality. Mean life annuities, life interests, assurances, &c.

Lessons 31—32.

Revision.

General reflections on the subjects comprised in the course.

II. DESCRIPTIVE GEOMETRY AND STEREOTOMY.

General Arrangements.

The pupils take in the lecture-room notes and sketches upon sheets, which are presented to the professor and the "répétiteurs" at each interrogation. The care with which these notes are taken is determined by "marks," of which account is taken in arranging the pupils in order of merit.

The plans are made according to programs, of which the conditions are different for different pupils. The drawings are in general accompanied with decimal scales, expressing a simple ratio to the metre. They carry inscriptions written conformably to the admitted models, and are, when necessary, accompanied with verbal descriptions.

In the graphic exercises of the first part of the course, the principal object is to familiarize the pupils with the different kinds of geometrical drawing, such as elevations and shaded sections, oblique projections, and various kinds of perspective. The pupils are also accustomed to different constructions useful in stereotomy.

The subjects for graphic exercises in stereotomy are taken from roofs, vaults, and staircases. Skew and oblique arches are the subject of detailed plans.

FIRST YEAR.

Descriptive Geometry.

Geometrical Drawing.

Lessons 1—3.

Revision and Completion of the Subjects of Descriptive Geometry comprised in the Programme for Admission into the School.

Object of geometrical drawing. Methods of projection. Representation of points, lines, planes, cones, cylinders, and surfaces of revolution. Construction of tangent planes to surfaces, of curves, of intersection of surfaces, of their tangents and their assymplotes.

Osculating plane of a curve of double curvature. A curve in general cuts its osculating plane.

When the generating line of a cylinder or a cone becomes a tangent to the directrix, the cylinder or cone in general has an edge of regression along this generating line. The osculating plane of the directrix at the point of contact touches the surface along this edge.

Projections of curves of double curvature; infinite branches and their assymplotes, Inflexions, nodes, cusps, &c.

Change of planes of projection.

Reduction of scale; transposition.

Advantage and employment of curves of error; their irrelevant solutions.

Lessons 4—6.

Modes of Representation for the Complete Definition of Objects.

Representation by plans, sections, and elevation.

Projection by the method of contours. Representation of a point, a line, and a plane; questions relative to the straight line and plane. Representation of cones and cylinders; tangent planes to these surfaces.

Lessons 7—11.

Modes of Representation which are not enough in themselves to define objects completely.

Isometrical and other kinds of perspective.

Oblique projections.

Conical perspective: vanishing points; scales of perspective; method of squares; perspective of curved lines; diverse applications. Choice of the point of sight. Rules for putting an elevation in perspective. Rule for determining the point of sight of a given picture, and for passing from the perspective to the plan as far as that is possible. Perspective of reflected images. Notions on panoramas.

APPENDIX F.

Descriptive Geometry. First Year.

Lessons 12, 13.

Representations with Shadows.

General observations on envelops and characteristics.

A developable surface is the envolop of the position of a moveable plane; it is composed of two sheets which meet. It may be considered as generated by a straight line, which moves so as to remain always a tangent to a fixed curve.

Theory of shade and shadow, of the penumbra, of the brilliant point, of curves of equal intensity, of bright and dark edges.

Atmospheric light: direction of the principal atmospheric ray. Notions on the degradation of tints; construction of curves of equal tint.

Influence of light reflected by neighbouring bodies.

Received convention in geometrical drawing on the direction of the luminous ray &c.

Perspective of shadows.

Lessons 14, 15.

Construction of Lines of Shadows and of Perspective of Surfaces.

Use of circumscribed cones and cylinders, and of the normal parallel to a given straight line.

General method of construction of lines of shadow and of perspective of surfaces by lane sections and auxiliary cylindrical or conical surfaces.

Construction of lines of shadow and perspective of a surface of revolution.

The curve of contact of a cone circumscribed about a surface of the second degree is a plane curve. Its plane is parallel to the diametral plane, conjugate to the diameter passing through the summit of the cone. The curve of contact of a cylinder circumscribed about a surface of the second degree is a plane curve, and situated in the diametral plane conjugate to the diameter parallel to the axis of the cylinder.

The plane parallel sections of a surface of the second degree are similar curves. The locus of their centres is the diameter conjugate to that one of the secant planes which passes through the centre of the surface.

General study of surfaces with reference to the geometrical constructions to which their use gives rise.

Lesson 16.

Complementary Notions on Developable Surfaces.

Development of a developable surface; construction of transformed curves and their tangents. Developable surface; an envelop of the osculating planes of a curve. The osculating plane of a curve at a given point may be constructed by considering it as the edge of regression of a developable surface; this construction presents some uncertainty in practice. Notions on the helix and the developable helicoid.

Approximate development of a segment of an undevelopable surface.

Lessons 17, 18.

Hyperbolic Paraboloid.

Double mode of generation of the paraboloid by straight lines; plane-directers; tangent planes, vertex, axis, principal planes; representation of this surface. Construction of the tangent plane parallel to a given plane. Construction of plane sections and of curves of contact, of cones, and circumscribed cylinders.

Scalene paraboloid. Isosceles paraboloid.

Identity of the paraboloid with one of the five surfaces of the second degree studied in analytical geometry.

Restatement without demonstration of the properties of this surface found by analysis, principally as regards its generation by the conic sections.

Lessons 19—20.

General Properties of Warped or Ruled Surfaces.

Principal modes of generation of warped surfaces. When two warped surfaces touch in three points of a common generatrix, they touch each other in every point of this straight line. Every plane passing through a generatrix touches the surface at one point in this line. The tangent plane at infinity is the plane-directer to all the paraboloids of "raccordement."

Construction of the tangent planes and curves of contact of circumscribed cones and cylinders. When two infinitely near generatrices of a warped surface are in the same plane, all the curves of contact of the circumscribed cones and cylinders pass through their point of concourse.

The normals to a warped surface along a generatrix form an isosceles paraboloid. The name of central point of a generatrix is given to the point where it is met by the straight ine upon which is measured its shortest distance from the adjoining generatrix. The locus of these points forms the line of striction of the surface. The vertex of the normal paraboloid along a generating line is situated at the central point. If the point of contact

of a plane touching a warped surface moves along a generatrix, beginning from the central point, the tangent of the angle which the tangent plane makes with its primitive position is proportional to the length described by the point of contact. The tangent plane at the central point is perpendicular to the tangent plane at infinity upon the same generatrix. Construction of the line of striction by aid of this property.

Lessons 21, 22.

Ruled Surfaces with plane-directers Conoids.

The plane-directer of the surface is also so to all the paraboloids of "raccordement." Construction of the tangent planes and curves of contact of the circumscribed cones and cylinders.

The line of striction of the surface is its curve of contact with a circumscribed cylinder perpendicular to the directer-plane. Determination of the nature of the plane sections.

The lines of striction of the scalene paraboloid are parabolas; those of the isosceles paraboloid are straight lines.

Construction of the tangent plane parallel to a given plane.

Conoid: discussion of the curves of contact of the circumscribed cones and cylinders.

Right conoid. Conoid whose intersection with a torus of the same height, whose axis is its rectilinear directrix, has for its projection upon the directer-plane two arcs of Archimedes' spiral. Construction of the tangents to this curve of intersection.

Lessons 23—25.

Ruled Surfaces which have not a Directer-Plane. Hyperboloid. Surface of the "biais passé."

Directer-cone: its advantages for constructing the tangent plane parallel to a given plane, and for determining the nature of the plane sections. The tangent planes to the points of the surface, situated at infinity, are respectively parallel to the tangent plane of the directer-cone. Developable surface which is the envelope of these tangent planes at infinity. Construction of a paraboloid of *raccordement* to a ruled surface defined by two directrices and a directrix cone.

Hyperboloid; double mode of generation by straight lines; centre; assymptotic cone.

Scalene hyperboloid; hyperboloid of revolution. Identity of the hyperboloid with one of the five surfaces of the second degree studied in analytical geometry.

Restatement without demonstration of the properties of this surface, found by analysis, principally as to what regards the axis, the vertices, the principal planes, and the generation by conic sections.

Hyperboloid of *raccordement* to a ruled surface along a generatrix; all their centres are in the same plane. Transformation of a hyperboloid of *raccordement*.

Surface of the *biais passé*. Construction of a hyperboloid of *raccordement*; its transformation into a paraboloid.

Construction of the tangent plane at a given point.

Lessons 26—28.

Curvature of Surfaces. Lines of Curvature.

Restatement without proof of the formula of Euler given in the course of analysis.

There exists an infinity of surfaces of the second degree, which at one of their vertices osculate any surface whatever at a given point.

In the tangent plane, at a point of a surface, there exists a conic section, whose dinameters are proportional to the square roots of the radii of curvature of the normal sections to which they are tangents. This curve is called the indicatrix. It is defined in form and position, but not in magnitude. The normal sections tangential to the axes of the indicatrix are called the principal sections.

The indicatrix an ellipse; convex surfaces; umbilici; line of spherical curvatures.

The indicatrix a hyperbola; surfaces with opposite curvatures.

The assymplotes of the indicatrix have a contact of the second order with the surface, and of the first order with the section of the surface by its tangent plane.

A ruled surface has contrary curvatures at every point. The second assymplotes of the indicatrices of all the points of the same generatrix form a hyperboloid, if the surface has not directer-plane,—a paraboloid, if it have one.

Curvature of developable surfaces.

There exists upon every surface two systems of orthogonal lines, such that every straight line subject to move by gliding over either of them, and remaining normal to the surface, will engender a developable surface. These lines are called lines of curvature.

The two lines of curvature which cross at a point, are tangents to the principal sections of the surface at that point.

Remarks upon the lines of curvature of developable surfaces, and surfaces of revolution.

Determination of the radii of curvature, and assymplotes of the indicatrix at a point of a surface of revolution.

APPENDIX F.

Descriptive Geometry. First Year.

Lessons 29, 30.

Division of Curves of Apparent Contour, and of Separation of Light and Shadow into Real and Virtual Parts.

When a cone is circumscribed about a surface, at any point whatever of the curve of contact, the tangent to this curve and the generatrix of the cone are parallel to two conjugate diameters of the indicatrix.

Surfaces, as they are considered in shadows, envelop opaque bodies, and the curve of contact of a circumscribed cone, only forms a separation of light and shadow, for a luminous point at the summit of the cone, when the generatrices of this cone are exterior. This line is thus sometimes real and sometimes virtual.

Upon a convex suface, the curve of separation of light and shade is either all real or all virtual. Upon a surface with contrary curvatures, this curve presents generally a succession of real and virtual parts: the curve of shadow cast from the surface upon itself presents a like succession. These curves meet tangentially, and the transition from the real to the virtual parts upon one and the other, take place at their points of contact in such a way that the real part of the curve of shadow continues the real part of the curve of separation of light and shade. The circumscribed cones have edges of regression along the generatrices, which correspond to the points of transition.

The lines of visible contour present analogous circumstances.

General method of determining the position of the transition points. Special method for a surface of revolution.

Lessons 31—34.

Ruled Helicoidal Surfaces.

Surface of the thread of the triangular screw; generation, representation, sections by planes and conical cylinders.

Construction of the tangent plane at a given point, or parallel to a given plane. The axis is the line of striction.

Construction of lines of shadow and perspective: their infinite branches, their assymplotes. Determination of the osculating hyperboloid along a generatrix.

Representation and shading of the screw with a triangular thread and its nut.

Surface of the thread of the square screw; generation, sections by planes and conical cylinders; tangent planes; curve of contact of a circumscribed cone.

The curve of contact of a circumscribed cylinder is a helix whose *step* is half that of the surface. Determination of the osculating paraboloid. At any point whatever of the surface, the absolute lengths of the radii of curvature are equal.

Representation and shading of the screw with a square thread, and of its nut.

Observations on the general ruled helicoidal surface, and on the surface of intrados of the winding staircase.

Lesson 35.

Different Helicoidal Surfaces.

Saint-Giles screw, worm-shaped screw and helicoidal surfaces to any generatrix. Every tangent to the meridian generatrix describes a screw surface with triangular thread, which is circumscribed about the surface, along a helix, and may be used to resolve the problems of tangent planes, circumscribed cylinders, &c.

Helicoid of the open screw, its generation, tangent planes.

Lessons 36, 37.

Topographical Surfaces.

Approximate representation of a surface by the figured horizontal projections of a series of equidistant horizontal sections. This method of representation is especially adapted to topographical surfaces, that is to say, surfaces which a vertical line can only meet in one point.

Lines of greatest slope. Trace of a line of equal slope between two given points.

Intersection of a plane and a surface, of two surfaces, of a straight line and a surface.

Tangent planes, cones, and cylinders circumscribed about topographical surfaces.

Use of a topographical surface to replace a table of double-entry when the function of two variables, which it represents, is continuous. It is often possible, by a suitable anamorphosis, to make an advantageous transformation in the curves of level.

Lesson 38.

Revision.

Review of the different methods of geometrical drawing. Advantages and disadvantages of each.

Comparison of the different kinds of surfaces, *résumé* of their general properties.

Object, method, and spirit of descriptive geometry.

SECOND YEAR.

STEREOTOMY.

WOOD-WORK.

Lessons 1—4.

Generalities.

Notions on the mode of action of forces in carpentry. Resistance of a piece of wood to a longitudinal effort and to a transversal effort. Distinction between resistance to flexure and resistance to rupture. Beams.

Advantages of the triangular system, St. Andrew's cross.

Lessons 5—8

Roofs.

Ordinary composition of roofs.

Distribution of pressures in the different parts of a girded roof.

Design of the different parts of roofs, &c., &c.

Lessons 9, 10.

Staircases.

MASONRY.

Lessons 11, 12.

Generalities.

Notions on the settlement of vaulted roofs. Principal forms of vaults *en berceau*, &c., &c.

Distribution of the pressures, &c.

Division of the intrados. Nature of the surfaces at the joints, &c., &c.

Lessons 13—15.

Berceaux and *descentes.*

Lessons 16—22.

Skew Arches.

Study of the general problem of skew arches.

First solution. Straight arches *en échelon.*

Second solution : Orthogonal *appareil.* True and principal properties of the orthogonal trajectories of the parallel sections of an elliptical or circular cylinder. Right conoid, having for directrices the axis of the circular cylinder and an orthogonal trajectory. The intersection of this conoid by a cylinder about the same axis is an orthogonal trajectory for a series of parallel sections.

Third solution : helicoidal. Determination of the angular elevation at which the surfaces of the beds become normal to the head planes; construction in the orthogonal and helicoidal *appareil* of the curves of junction upon the heads, and the angles which they form with the curves of intrados. Cutting of the stones in these different constructions. Broken helicoidal *appareil*, for very long skew arches.

Helicoidal *trompes* at the angles of straight arches ; *voussures* or widenings, which it is necessary to substitute near the heads at the intrados of an arch with a considerable skew ; case where the skew is not the same for the two heads. Orthogonal trajectories of the converging sections of a cylinder.

Lessons 23—25.

Conical Intrados—Intrados of Revolution.

Skew *trompe* in the angle. Suggestions on the general problem of conical skew vaulted roofs.

Spherical domes, &c.

Lessons 26, 27.

Intrados, a Ruled Surface.

Winding staircases, &c., &c.

APPENDIX F.

Stereotomy. Second Year.

Lesson 28.

Helicodial Intrados.

Staircase on the Saint-Giles screw.

Lessons 29—31.

Composite Vaulted Roofs.

Various descriptions of vaults.
Suggestions on vaulted roofs with polygonal edges and with ogival edges.

Lesson 32.

Revision.

Spirit and method of stereotomy.
Degree of exactness necessary. Approximate solutions. Case where it is proper to employ calculation in aid of graphical constructions.
Review and comparison of different *appareils.*

MECHANICS AND MACHINES.

General Arrangements.

The pupils execute during the two years of study:—

1. Various drawings or plans of models in relief, representing the essential and internal organs of machines, such as articulations of connecting rods, winch-handles and fly-wheels, grease-boxes, eccentrics worked by cams or circles giving motion to rods; the play of slides, &c.; cylinders of steam-engines, condenser, pistons, and various suckers; Archimedes' screw, and other parts of machines.

The sketches of the plan drawings are traced by hand and figured. The drawings in their finished state are washed and coloured according to the table of conventional tints; they all carry a scale suitably divided.

2. A drawing of wheel-work by the method of development, and tracing the curves of teeth by arcs of circles from which they are developed. This drawing represents, of the natural size, or on any other scale of size considered suitable to show the nature of the partial actions only, a small number of teeth either in development or projection; the entire wheel-work is represented by the usual method of projection, where in drawings on a small scale the teeth are replaced by truncated pyramids with a trapezoidal base.

3. Finally, numerical exercises concerning the loss of work due to the prejudicial resistances in various machines, the gauging of holes, orifices, &c.

Models in relief, or drawings on a large scale, of the machines or elements of the machines mentioned in the course, assist in explaining the lessons. They are brought back, as often as found necessary, under the eyes of the students. When possible, lithographic sketches of the machines, or the elements of the machines, which ought to enter into the course, are distributed among the pupils.

The pupils, divided into sections, pay their first visit to the engine factories towards the end of their first year of study; they make one or more additional visits at the end of the second year.

FIRST YEAR.

Part I.—Kinematics.

Preliminary Elementary Movements of Invariable Points and Systems.

Lessons 1, 2.

Object of kinematics, under the geometrical and experimental point of view. Its principal divisions.

Restatement of the notions relative to the motion of a point, its geometrical representation, and more especially the determination of its velocity.

Simultaneous Velocities of a Point and the Increments of its Velocities.

Ratio of the elementary displacement and the velocity of a point to the displacement, and velocity of its projection upon a straight line or plane. Use of infinitesimals to determine these ratios. Example;—Oscillatory motion of the projection upon a fixed axis of a point moving uniformly upon the circumference of a circle.

Analogous considerations for polar co-ordinates. Relations of the velocity of a point, of its velocity of revolution and its angular velocity about a fixed pole ; of its velocity in the direction of the radius vector ; of the velocity of increase of the area which this radius describes.

Simple Motions of Solids, or Rigid Systems.

1. Motion of rectilinear or curvilinear translation ; simultaneous displacements, and velocities of its different points. 2. Motion of rotation about a fixed axis ; relation of the velocities of different points to the angular velocity.

Geometrical notions and theorems relative to the *instantaneous centre* of rotation of a body of invariable figure and moveable in one plane, or to the *instantaneous axis* of rotation of a rigid system situated in space, and moveable parallel to a fixed plane. Relation of the velocities of different points to their common angular velocity. Use of the instantaneous centre of rotation for tracing tangents ; examples—and amongst others —that of the plane curve described by a point in a straight line of given length, whose extremities slide upon two fixed lines. Rolling of a curve upon another fixed curve in a plane. Descartes' theorems upon the intersection of the normals at the successive points of contact : cycloids, epicycloids, involutes, and evolutes. Extension of the preceding motions to the instantaneous axis of rotation of a rigid system moveable about a fixed point.

Composition of Motions.

Lessons 3—6.

Composition of the Velocities of a Point.

Polygon of velocities. Example of movements observed relatively to the earth. Particular cases ; composition of velocities taken along three axes ; composition of the velocity of a point round a fixed pole, and its velocity along the radius vector. Method of Roberval for tracing tangents.

Composition of the Simple Motions of a Solid System.

Composition of any number of translatory displacements of a solid. Composition of two rotations about two intersecting axes. Composition of any number of rotations about axes cutting one another at the same point; parallelopiped and polygon of rotations. Composition of two simultaneous rotations about parallel axes ; case where the rotations are equal and of opposite kinds. Decomposition of a rotation about an axis into an equal rotation about any axis whatever parallel to the first, and a translation perpendicular to the direction of this axis. Direct and geometrical decomposition of the most general motions of a body into a rotation about, and a translation along, an axis called the *instantaneous axis*. Composition of any two motions whatever. Every movement of an invariable system is at each instant of time decomposable into three movements of rotation, and three movements of translation with respect to three axes, which are neither parallel nor lying in the same plane, but otherwise arbitrarily chosen.

Relative or Apparent Motions.

Relative motion of two points whose absolute motions are given graphically *à priori*. Trajectory of the relative motions, relative velocities, and displacements upon curves or upon the direction of the mutual distance of the two points ; use of the parallelogram to determine its amount. Relative motion of a point in motion in respect of a body turning about a fixed axis ; relative motion of two bodies which turn about parallel or converging axes, and in general of two rigid bodies or systems impelled by any motions whatever. How this problem is immediately reduced to that of the composition of given motions.

The most general continued motion of an invariable figure in a plane is an *epicycloidal* motion, in which the instantaneous centre describes a curve fixed in relation to absolute space, and traces relatively to the proposed figure a moveable curve, which is rigidly connected with that figure and draws it along with it in its motion of rolling upon the other fixed curve. Case of space or spherical figures.

On the Accelerated Motion of a Point.

Lessons 7—9.

Accelerated Rectilinear Motion.

Restatement of the motions acquired relatively to the acceleration in the variable rectilinear motion of a point. Brief indication of the solution of six problems arising out of the investigation of the laws of the motion in terms of the space, time, velocity, and accelerating force. For the most part these solutions may be brought to depend on exact or approximate quadratures. Numerical exercises.

Accelerated Curvilinear Motions.

Restatement of the notions acquired relative to the composition of accelerating forces ; the resulting acceleration, the normal and tangential acceleration animating a point in

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motion on a curve. The total acceleration of a point upon an axis or plane is the projection upon this axis or plane of the acceleration of the moving body in space. In uniform curvilinear motion the total or resultant acceleration becomes normal to the curve. Particular case of the circle; value of the normal acceleration in terms of the velocity of revolution or the angular velocity of the radius vector. Case of any curve whatever; geometrical expression of the total or resultant acceleration.

Accelerated Compound and Relative Motions.

Geometrical investigation of the simple and compound accelerations arising out of the hypothesis in which the motion of any system of points whatever is referred to another system of invariable form, but also in motion. Geometrical and elementary explanations of the results obtained by means of the transformation of co-ordinates.

Examples or Exercises chosen from among the following Questions:—

Projection of circular and uniform motion upon a fixed straight line or plane; motion of a circle which rolls uniformly on a straight line; comparison of the motions of the planets relatively to each other, treating them as circular and uniform; comparison of the accelerating force on the moon with that of bodies which fall to the earth.

GEOMETRICAL THEORY AND APPLICATION OF MECHANISMS OR CONTRIVANCES FOR THE TRANSFORMATION OF MOTION.

Lessons 10—19.

Succinct notions on the classification of elementary motions and organs for transmission of motion in machines after Monge and Hachette, Lanz and Bétancourt.

The most essential details upon this subject are set forth in the following order, and made clear by outline drawings previously distributed among the pupils.

Organs fitted to regulate the direction of the circular or rectilinear motion of certain pieces.

Axle; trunnions, gudgeons; pivots and bearings; couplings of axes; adjustment of wheels and of their arms. Joints with hinges, &c.; sheaves and pullies; chains, ropes, and straps; means of securing them to the necks. Grooves and tongue-pieces. Eyelet-holes sliding along rectilinear or curvilinear rods. Advantages and disadvantages of these different systems of guides under the point of view of accuracy.

Rapid indication of some of their applications to drawbridges and to the moveable frames or waggons of saw-works and railways.

Transmission at a Distance of Rectilinear Motion in a determinate Direction and Ratio.

Inclined plane or wedge guiding a vertical rod. Wedge applied to presses. Rods, winch-handles, &c. Disposition of drums or pullies in the same plane or in different planes; geometrical problem on this subject. Fixed and moveable pullies. Blocks to pullies. Simple and differential wheel and axle moved by cords. Transmission through a liquid. Ratios of velocities in these different organs.

Direct Transformation of circular progressive motion into progressive and intermittent rectilinear motion.

Rod conducted between guides: 1°, by the simple contact of a wheel; 2°, by cross-straps or chains; 3°, by a projecting cam; 4°, by means of a helicoidal groove set upon the cylindrical axis of the wheel. To-and-fro movement, and heart-shaped or continuous cam, waves, and eccentrics. Simple screw and nut. Left and right handed screws; differential screw of Prony, called the micrometric screw. Ratio of the velocities in these different organs.

The example of the cam and pile-driver will be particularly insisted upon; 1°, in the case where this cam and the extremity of the rod have any continuous form given by a simple geometrical drawing; 2°, in the case where this form is defined geometrically by the condition, that the velocity is to be transmitted in an invariable ratio, as takes place for cams in the form of epicycloids or involutes of circles.

Transformation of a circular progressive motion into another similar to the first.

1°, by contact of cylinders or cones, the two axes being situated in the same plane; 2°, by straps, cords, or endless chains, the axes being in the same situation; 3°, by cams, teeth, and grooves, at very slight intervals; 4°, by the Dutch or universal joint. Case, where the axes are not situated in the same plane; use of an intermediate axis with bevelled wheels or a train of pulleys; idea of White or Hooke's joint in its improved form. Endless screw specially employed in the case of two axes at right angles to one another. Combinations or groupings of wheels. Idea of differential wheels. Relations of velocities in the most important of these systems of transmission.

Transformation of circular progressive Motion into rectilinear or alternating circular motion.

Ordinary circular eccentric. Eccentrics with closed waves or cams. Examples and graphical exercises in the class-rooms relative to the alternate action of the travelling frames of saw-mills, of the slides or entrance valves of steam-engines. Cams for working hammers and bellows.

Transformation of alternating circular motion into alternating rectilinear motion, or into intermittent and progressive circular motion.

Pump rods with or without circular sectors, &c. Examples taken from large exhausting pumps, fire-engines, and common pumps. Suggestions as to the best arrangement of the parts. Lagarousse's lever, &c. Application of the principle relative to the instantaneous centre of rotation to give the relations of the velocities in certain simple cases.

Transformation of alternating circular or rectilinear motions into progressive circular motion.

The knife-grinder's treadle. System of great machines worked with connecting rods, fly-wheel, &c. Watt's parallelogram, and the simplest modifications of it for steam-boats, for instance. The most favourable proportions for avoiding the deviation of piston-rods. Simplification of parts in the modern steam-engines of Maudsley, Cavé, &c. Variable ratios of the velocities.

Of Organs for effecting a sudden change of motion.

Suspendors or moderators, &c. Dead wheels and pullies, &c. Mechanisms for stretching cords or straps, and make them change pullies during the motion. Brakes to windmills, carriages, &c., &c. Case where the axes are rendered moveable. Means for changing the directions and velocity of the motions. Coupled and alternate pullies; alternate cones; castors moving by friction and rotation upon a plate or turning-cone; eccentric and orrery wheels. Means of changing the motion suddenly and by intervals; wheels with a detent pile-drivers; Dobo's escapement for diminishing the shock, &c.

Geometrical Drawing of Wheel-Work.

General condition which the teeth of toothed wheels must satisfy. Consequence resulting from this for the determination of the form of the teeth of one of two wheels, when the form of the teeth of the other wheel is given.

Cylindrical action of toothed wheels or toothed wheels with parallel axes. External engagement of the teeth; internal engagement. Particular systems of toothed wheels; lantern wheels, flange wheels, involutes of circles. Reciprocity of action; case where the action cannot be rendered reciprocal. Pothook action. Details as to the form and dimensions given in practice to the teeth and the spaces which separate them.

Conical action of toothed wheels, or toothed wheels with converging axes. Practical approximate method of reducing the construction of a conical to that of a cylindrical engagement of toothed wheels.

Means of observation and apparatus proper for discovering experimentally the law of any given movement.

Simple methods practised by Galileo and Coulomb in their experiments relative to the inclined plane and the motion of bodies sliding down it. Various means of observing and discovering the law of the translatory and rotatory motion of a body according as the motion is slow or rapid. Determination of the angular velocity, &c. The counter in machines. Apparatus of Mattei and Grobert for assigning the initial velocity of projectiles (musket balls). Colonel Beaufoy's pendulum apparatus. Chronometrical apparatus for continuous indications by means of a pencil. Eytelwein's apparatus with bands, and its simplest modifications. Apparatus with cylinders or revolving disks. Use of the tuning-fork for measuring with precision very small fractions of time.

(The principal sorts of the apparatus above described are made to act under the eyes of the pupils.)

Part II.—Equilibrium of Forces applied to Material Systems.

Lesson 21.

Résumé of the notions acquired upon the subject of forces, and their effects on material points.

Principle of inertia, notion of force, of its direction, of its intensity. Principle of the equality of action and reaction. What is meant by the force of inertia? Principle of the independence and composition of the effects of forces. Forces proportional to the acceleration which they produce on the same body. Composition of forces. Relation between the accelerating force, the pressure, and the mass. Definition of the work done by a force. The work done by the resultant is equal to the sum of the works done by

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the components. Moment of a force in relation to an axis deduced from the consideration of the work of the force applied to a point turning about a fixed line. The moment of the resultant of several forces applied to a point is equal to the sum of the moments of the components. Corresponding propositions of geometry.

Lessons 22—25.

Succinct Notions upon the Constitution of Solid Bodies.

Every body or system of bodies may be regarded as a combination of material points isolated or at a distance, subject to equal and opposite mutual actions. Interior and exterior forces. Example of two molecules subject to their reciprocal actions alternately, attractive and repulsive, when the forces applied draw them out of their position of natural equilibrium. Different degrees of natural solidity, stability, or elasticity; they can only be appreciated by experience.

Equilibrium of any Systems whatever of Material Points.

General theorem of the virtual work of forces applied to any system whatever of material points. It is applicable to every finite portion of the system, provided regard be had to the actions exercised by the molecules exterior to the part under consideration. Determination of the sum of the virtual works of the equal and reciprocal actions of two material points. Demonstration of the six general equations of equilibrium of any system whatever. They comprise implicitly *every* equation deduced from a virtual movement compatible with the presupposed solidification of the system.

Theorem on the virtual work in the case of systems where one supposes ideal connexions, such as the invariability of the distance of certain points of the system from one another, and the condition that certain of them are to remain upon curves either fixed or moving without friction.

Equilibrium of Solid Bodies.

The six general equations of equilibrium are sufficient as conditions of the equilibrium of a solid body. Theory of moments and couples.

Applications.

Lessons 26—29.

Equilibrium of Heavy Systems.

Recapitulation of some indispensable notions for the experimental determination of the centre of gravity of solids when the law of their densities is unknown. Restatement of the theorem relative to the work done by gravity upon a system of bodies connected or otherwise. In machines supposed without friction submitted, with the exception of their supports, to the action of gravity alone, the positions of stable or unstable equilibrium correspond to the highest or lowest points of the curve which would be described by the centre of gravity of the system when made to move. Influence of defect of centring in its wheels, upon the equilibrium of a machine. Case where the centre of gravity always remaining at the same height the equilibrium is neutral. Examples relative to the most simple drawbridges, &c.

Equilibrium of Jointed Systems.

Equilibrium of the funicular polygon deduced from direct geometrical considerations: Varignon's theorem giving the law of the tensions by another polygon whose sides are parallel and proportional to the forces acting upon the vertices of the funicular polygon. Case of suspension bridges; investigation of the curve which defines the boundary of the suspension chain; tensions at the extremities.

Equilibrium of systems of jointed rigid bodies without friction. Determination of the pressure upon the supports and the mutual actions at the joints.

Equilibrium and stability of solid bodies submitted to the action of stretching or compressing forces.

Permanent resistance and limiting resistance of prisms to longitudinal extension and compression. Equilibrium and stability of a heavy solid placed upon a horizontal plane and submitted to the action of forces which tend to overset it. Resultant pressure and mean pressure; hypothetical distribution of the elements of the pressure on the base of support. Conditions of stability, regard being had to the limit of resistance of solid materials, co-efficient of stability deduced from it.

Part III.—On the Work done by Forces in Machines.

Lessons 30—39.

General Notions.

Principle of work in the motion of a material point. Extension of this principle to the case of any material system whatever in motion. Considerations relative to mechanical work in various operations, such as the lifting of weights, sawing, planing, &c. It is the true measure of the productive activity of forces in industrial works. It may

always be calculated either rigorously or approximately when the mathematical or experimental law which connects the force with the spaces described is given. Uniform work, periodical work, mean work, for the unit of time. Horse-power unit. Examples and various exercises, such as the calculation of the work corresponding to the elasticity of gases on the hypothesis of Mariotte's law, the elongation of a metallic prism, &c.

Dynamometrical Apparatus.

Dymanometer of traction by a band or rotating disc or register. Dynamometer of rotation with simple spring, with band or register. Dynamometer of rotation with multiple springs and with register for the axles of powerful machines. Improved indicator of Watt.

(These pieces of apparatus are made to act under the eyes of the pupils.)

Work of Animal Prime Movers upon Machines.

Results of experience as to the values of the daily work which animal motors can supply under different circumstances without exceeding the fatigue which sleep and nourishment are capable of repairing.

Theory of the Transmission of Work in Machines.

Principal resistance. Secondary resistances. Two manners in which bodies perform the duty of motors. Ratio of work done to work expended always inferior to unity. Different parts of machines; receiver; organs of transmission; tools as machines.

Calculation of the Work due to the passive resistances in machines.

Résumé of the notions previously acquired on friction. Application to the inclined plane, to the printing-press, to guides or grooves, to the screw with a square thread; different cases of uniform motion being impossible under the action of forces of given directions. Friction of trunnions, pivots, eccentrics, and insertions of winch handles. Prony's dynamometrical brake; conditions of its application. Resistance to rolling; its laws according to experiment. Use of rollers and friction-wheels; their practical inconveniences.

Mixed friction of toothed wheels; the Dobo escapement: friction of the teeth in the endless screw.

Stiffness and friction of cords. Results of experience. Friction of cords and straps running round drums. Different applications; brakes; transmission by cords, endless straps, or chains.

Examples and exercises; effects of passive resistances in the capstan, the crane, pullies, &c.

Lesson 40.

Revision.

SECOND YEAR.

Part I.—Dynamics.

Dynamics of a Material Point.

Lessons 1, 2.

Completion of the Notions acquired on this Subject.

Differential equations of the motion of a material point submitted to the continued action of one or more forces. The acceleration of the projection of a point upon any axis or plane is due to the projection of the forces on this axis or plane. The acceleration along the trajectory is due to the tangential force. Relation of the curvature to the centripetal force. Introduction of the force of inertia into the preceding enunciations.

The increase of the quantity of motion projected upon an axis or taken along the trajectory is equal to the impulsion of the projected resultant, or to that of the total tangential force. The total impulsion of a force is got by methods of calculation and of experiment analogous to those which relate to *work*. The increase of the moment of the quantity of motion in relation to any axis is equal to the total moment of the impulsions of the forces during the same interval of time; direct geometrical demonstration of this theorem. In decomposing the velocity of the moving body into a velocity in the plane passing through the axis of the moments, and a velocity of revolution perpendicular to this plane, we may replace the moment of the quantity of motion in space by the quantity of motion of revolution. Particular case known under the name of the principle of areas.

Extension of the preceding theorems to the case of relative motions. Apparent forces which must be combined with the real ones that the relative motion of a point may be assimilated to an absolute motion. Particular case of relative equilibrium. Influence of the motion of the earth upon the accelerating force of gravity.

APPENDIX F.

Mechanics and Machines. Second Year.

Dynamics of any Material Systems.

Lessons 3—8.

Principle or general rule which reduces questions in dynamics to questions in equilibrium by the addition of the forces of inertia to the forces which really act on the system. Equation of virtual work which expresses this equilibrium; it comprises in general the external and internal forces.

General Theorems.

These theorems, four in number, are founded upon the principle of the equality of action and reaction applied to internal forces. They may be deduced from the preceding rule, but the three last are obtained more simply by extending to a system of material points analogous theorems established for isolated material points.

General theorem of the motion of the centre of gravity of a system. Particular case called *principle of the conservation of the motion of the centre of gravity.*

General theorem on the quantities of motion and impulsions of exterior forces projected on any axis.

General theorems of moments of quantities of motion and impulsions of exterior forces, projected on any axis whatever.

General theorems of the moments of quantities of motion and impulsions of exterior forces about any axis. Analogy of these two theorems with the equations of the equilibrium of a solid, in which the forces are replaced by impulsions and quantities of motion.

Composition of impulsions, of quantities of motion, or the areas which represent them. All the equations which can be obtained by the application of the two theorems relative to quantities of motion and impulsions, reduce themselves to six distinct equations. Particular case called *principle of the conservation of areas.* Fixed plane of the resulting moment of the quantities of motion called *plane of maximum areas.*

General theorem of work and *vis viva.* Part which appertains to the interior forces in this theorem. Particular case called principle of the conservation of *vires vivæ*, where the sum of the elements of work done by the exterior and interior forces is the differential of a function of the co-ordinates of different points of the system. Application of the theorem of work to the stability of the equilibrium of heavy systems.

Extension of the preceding theorems to the case of relative motions. Particular case of relative equilibrium. Motion of any material system relative to axes always passing through the centre of gravity, and moving parallel to themselves. Invariable plane of Laplace. Relation between the absolute *vis viva* of a material system, and that which would be due to its motion, referred to the system of moveable axes above indicated.

Examples and Applications.

The following examples, amongst others, to be taken as applications or subjects of exercises relative to the general principles which precede.

Walking. Recoil of guns. Eolypile. Flight of rockets.

Pressure of fluid veins, resistance of mediums, &c. Direct collision of bodies more or less hard, elastic, or penetrable. Exchange of quantities of motion. Loss of *vis viva* under different hypotheses. Influence of vibrations and permanent molecular displacements.

Pile driving; advantage of large rammers. Comparison of effects of the shocks and of simple pressures due to the weight of the construction. Oblique collision, and ricochet. Data furnished by experiment.

Oscillations of a vertical elastic prism suspended to a fixed point, and loaded with a weight, neglecting the inertia, and the weight of the material parts of this prism. Case of a sudden blow. What is meant by the "*resistance vive*" of a prism to rupture? Results of experiments.

Work developed by powder upon projectiles, estimated according to the *vis viva* which it impresses on them, as well as upon the gun and the gases upon the hypothesis of a mean velocity.

Special Dynamics of Solid Bodies.

Lessons 9—12.

Simple Rotation of an invariable Solid about its Axis.

In applying to this case the first general rule of dynamics, the theorem of the moments of the quantities of motion, and the theorem of work, we are led to the notion of the moment of inertia; explanation of the origin of this name. The angular acceleration is equal to the sum of the moments of the exterior forces divided by the moment of inertia about the axis of rotation. Sum of the moments of the quantities of motion relative to this axis. *Vis viva* of a solid simply turning about an axis. What is meant by *radius of gyration?*

Remind of the geometrical properties of moments of inertia, of the ellipsoid which represents them, of the principal axes at any point, of those which are referred to the centre of gravity.

Pressure which a rotating body exercises on its supports. Reduction of the centrifugal and tangential forces of inertia to a force which is the force of inertia of the entire mass accumulated at the centre of gravity, and a couple.

Particular case where the forces of inertia have a single resultant ; different examples. Centre of percussion. Compound pendulum ; length of the corresponding simple pendulum. Centre of oscillation ; reciprocity of the centres or axes of suspension and oscillation. Pressure upon the axis. Influence of the medium ; experience proves that the resistance, varying with the velocity, changes the extent of the oscillations, but does not sensibly affect the time. Experimental determination of the centre of oscillation and the moment of inertia about an axis.

Motion of an invariable Solid subject to certain Forces.

General notions on this subject. Motion of the centre of gravity ; motion of rotation about this point.

Lessons 13—19.

Various Applications.

Motion of a homogeneous sphere or cylinder rolling upon an inclined plane, taking friction into account.

Motion of a pulley with its axis horizontal, sollicited by two weights suspended vertically to a thread or fine string passing round the neck of the pulley, the axle of which rests upon moveable wheels. Atwood's machine serving to demonstrate the laws of the communication of motion.

Motion of a horizontal wheel and axle acted on by a weight suspended vertically to a cord rolled round the axle, or upon a drum with the same axis, and presenting an eccentric mass. To take account of the variable friction of the bearings, and the stiffness of the cord, with recourse, if necessary, to approximation by quadratures. Oscillations of the torsion balance.

Balistic pendulum. Condition that there may be no shock on the axis. Experimental determination of the direction in which the percussion should take place.

Theory of Huyghen's conical pendulum considered as a regulator of machinery. How to take account of the inertia and friction of the jointed rods, as well as of the force necessary to move the regulating lever, &c. ; appreciation of the degree of sensibility of the ball apparatus with a given uniform velocity.

Windlass with fly-wheel. Dynamical properties of the fly-wheel. Reduced formulæ for a crank with single or double action. Advantages and disadvantages of eccentric masses. Tendency of the tangential forces of inertia to break the arms. Numerical examples and computations.

Mutual action of rotating bodies connected by straps or toothed wheels in varying motion.

The wedge and punching-press. Stamping screw or lever used in coining, cams, lifting a pile or a hammer. To take account of the friction during the blow, and afterwards to estimate the loss of *vis viva* in cases which admit of it.

Part II.—Special Mechanics of Fluids.

Hydrostatics.

Lessons 20—22.

Principle of the equality of pressure in all directions. Propagation of the pressures from the surface to the interior of a fluid, and upon the sides of the vessel. Equations of equilibrium for any set of forces. Pressure exerted in the containing orifices. Measure of the pressure upon a plain portion of surface inclined or vertical (sluice-gate, embankments, &c). Centre of push or pressure. Pressure against the surfaces of a cylindrical tube. Effect, and resistance to oppose to the pressure. Manometer and piezometer. Equilibrium of a body plunged in a heavy fluid or floating at its surface. Stability of floating bodies. Metacenter. Laws of the pressure in the different atmospheric strata.

Hydraulics.

Lessons 23—27.

Flow of Fluids through small Orifices.

Study of the phenomena which accompany this flow in the case of a thin envelop and a liquid kept at a constant level. Conditions of this constancy in the level, and the permanence of the motion in general. Motion of the lines of fluid ; form ; contraction ; reversal and discontinuity of liquid veins. Fundamental formulæ for liquids and gases based upon the principle of *vis viva*, and Bernouilli's hypothesis of parallel sections or Borda's of contiguous threads. Torricelli's theorem relative to small orifices. What is called the theoretical expenditure, effective expenditure, and co-efficient of geometrical contraction. Co-efficient deduced from the effective expenditure. Its variations with the volume of the fluid contents, and the form of the inner surfaces of the reservoir. Results of the

APPENDIX F.

Mechanics and Machines. Second Year.

experiments of Michelotti, Borda, Bossut, &c. Phenomenon of adjutages. Venturi's experiments; influence of atmospheric pressure; loss of *vis viva;* reduction of the velocity and augmentation of the expenditure. Results of experience relative to the co-efficient of expenditure, the form and range of the parabolic jets, showing the initial *vis viva*, and the loss of *vis viva.*

Large orifices.—Sluice holes and floodgates; reservoirs or open orifices; expenditure; practical formulæ and results of experiment. Influence of the proximity of the sides and the walls. Arrangement to avoid the effects of contraction or the losses of *vis viva.*

Flow through conducting Pipes and open Canals.

Practical formulæ relative to the case of uniform sections of great length. Measure of the pressures at different points of a conduit-pipe. Expression for the losses of effect due to corners and obstructions. Flow of gases. Principal methods of measuring the volume consumed adopted in practice. Floats. Pitot's tube. Woltman's mill. Register mill in air or gas. Waste in such instruments. Modulus and scale for water-supply.

PART III.—DIFFERENT MACHINES CONSIDERED IN THE STATE OF MOTION.

Lesson 28.

General Considerations. Resmué of the Notions acquired on this Subject.

Equation of *vis viva*, and transmission of work in machines, account being taken of the different causes of power and resistance. Physical constitution of machines; *receiver, communicators*, and *operator.* Influence of the weights, of frictions, of shocks, and any changes in the *vis viva.* Parts with continuous or uniform motion, with alternating or oscillating motion. Laws of the motion on starting from rest, and when the stationary condition is established. The positions to which the maximum and minimum of the *vis viva* correspond are those in which there is equilibrium between all the forces, exclusive of the forces of inertia. Advantage of uniform or periodic motion. General methods for regulating the motion; symmetrical distribution of the masses and strains; flys and various regulators. Brake's and moderators; their inconveniences. Object and real advantages of machines.

Lessons 27—35.

Hydraulic Wheels.

Vertical wheels with float-boards, with curved ladles, and with spouts. Figure of the surface of the fluid in these latter. Horizontal wheels working by float-boards, buckets, and reaction. Turbines. Description, play, and useful effects compared according to the results of experiment. Vertical wheels of windmills and steam-boats. Screw propeller.

Windmills.

Description. Result of Coulomb's observations.

On the principal kinds of Pumps.

Special organs of pumps. Valves and pistons, force pump, sucking pump; limit to the rise of the water. Sucking and force pump. Dynamical effects. Indication as to the losses of *vis viva* and the waste in different pumps. Explanation of the hydraulic ram. Air vessel. Fire pumps. Double action pumps.

Various Hydraulic Machines.

Hydraulic press. Water engine. Exhausting machines; *norias;* under and over shot wheels; Archimides' screw, construction and experimental data.

Lessons 36—39.

Steam Engines.

Succinct description of the principal kinds of steam engine with or without detent Effects and advantages of the detent. Condenser. Air Pump. Furnace and feeding. pump.

Variable detent. Formulæ and experimental results.

Lessons 40—42.

Revision.

Reflections on the totality of the subjects of the course.

IV. PHYSICS.—FIRST YEAR.

General Properties of Bodies.—Hydrostatics.—Hydrodynamics.

Lessons 1—5.

Preliminary Notions.

Definitions of physics. Phenomena. Physical laws. Experiments are designed to make them spring out of the phenomena. Method of induction. Physical theories; different character of the experimental and mathematical methods.

General Properties of Bodies.

Extension. Measure of lengths. Vernier. Cathetometer. Micrometer screw. Spherometer. Dividing engine.

Divisibility. Porosity. Ideas generally received on the molecular constitution of bodies. These conceptions, which are purely hypothetical, must not be confounded with physical laws. Elasticity. Mobility. Inertia. Forces; their equilibrum, their effects, their numerical estimation.

Weight or Gravity.

Direction of gravity. Plumb-line. Relation between the direction of gravity and the surface of still water.

Weight. Centre of gravity.

Experimental study of the motion produced by weight. In vacuum, all bodies fall with the same velocity. Disturbing influence of the air. Inclined plane of Galileo. Atwood's machine. To prove by experiment; 1° the law of the spaces described; 2° the law of velocities. Morin's self-registering apparatus with revolving cylinder.

Law of the independence of the effect produced by a force upon a body, and the motion anteriorily acquired by this body. Law of the independence of the effects of forces which act simultaneously upon the same body. Experimental demonstration and generalization of these laws. Law of the equality of action and reaction.

Mass. Acceleration. For equal masses the forces are as the accelerations which they produce. Relation between the force, mass, and acceleration. Collision.

General laws of uniformily accelerated motion. Formulæ.

Pendulum. Law of the isochronism of small oscillations, and law of the lengths deduced from observation.

Method of coincidences or beats. Use of the pendulum as the measure of time. Simple pendulum; formulæ. Compound pendulum: the laws of the oscillations of a compound pendulum are the same as the laws of the oscillations of a simple pendulum whose length may be calculated.

Determination by means of the pendulum of the acceleration produced by gravity. This acceleration is independent of the nature of the body.

Remark that the formulæ for the motion of oscillation apply to the comparison of forces of any kind, that may be regarded as constant and parallel to themselves in all positions of the oscillating body.

Identity of gravity and universal attraction.

Measure of weights. Balance. Conditions to be attended to in making it. Absolute sensibility; proportional sensibility. Method of double weighing. Details of the precautions necessary in order to obtain an exact weight.

Different States of Bodies.—Hydrostatics.

Solids. Cohesion. Transmission of external pressures.

Elasticity. The true laws of elasticity are unknown. Empirical laws in certain simple cases, and for a very small action. Elasticity of compression, extension, torsion. Experimental determination of the co-efficients of elasticity. Limits of elasticity. Limits of tenacity.

Ductility. Temper. Cold hammering. Annealing.

Liquids. Fluidity. Viscosity. Physical laws which form the basis of hydrostatics:—1° the transmission of external pressures is equal in all directions; 2° the pressure exercised in the interior of a liquid upon an element of a surface is normal to that element, and independent (as to amount) of its direction. These principles are demonstrated by the experimental verification of the consequences drawn from them.

Application to heavy liquids. Free surface, and surface *de niveau*. Pressure upon the parts of the containing vessel, and upon the bottom in particular; hydrostatic paradox; verificatory experiments. Haldat's apparatus. Hydrostatic press.

Application to immersed or floating bodies (principle of Archimedes); verificatory experiments. (In treating of the equilibrum of floating bodies, the conditions of stability are not gone into.)

Superposed liquids.

Communicating vessels. Water level. Spirit level; its use in instruments.

Densities of solids and liquids. Anemometers.

APPENDIX F.

Physics. First Year.

Compressibility of liquids. Piezometer. Correction due to the compressibility of the the solid envelop.

Gas. Expansibility. Other properties common to liquids and gases. Principle of the equal transmission of pressures in all directions. Weight of gases. Pressure due to weight (principle of Archimedes). Weight of body in air and in vacuum. Aerostation.

Superposed liquids and gases.

Communicating vessels. Barometer.

Detailed construction of barometer. Barometers of Fortin, Gay-Lussac, Bunten. Indication of the corrections necessary.

Mariotte's law. Regnault's experiments.

Manometer with atmospheric air—with compressed air. Bourdon's manometer.

Law of the mixture of gases.

Air pump. Condensing pump.

Primary Notions of Hydrodynamics.

Toricelli's principle. Mariotte's vessel and syphon. Uniform flow of liquids. The same of gases.

Molecular Phenomena.

Cohesion of liquids. Adhesion of liquids to solids. Capillary phenomena. Apparent attractions and repulsions of floating bodies.

Adhesion of drops.

Molecular actions intervene as disturbing forces in the phenomena of the equilibrium and motion of liquids.

HEAT.

Effects of Heat on Bodies.

Lessons 6—9.

Generalities.

General effects. Arbitrary choice of one of these effects to define the thermometric condition of a body. Conventional adoption of a thermometer. Definition of temperature.

Dilating Effects.

Definition of the co-efficients of linear, superficial, and cubic dilatation. Approximate relation between the numerical values of these three co-efficients. The value of the co-efficient of dilatation depends upon the thermometric substance and the temperature selected as the zero point. It becomes nearly independent of the zero point when the co-efficient is very small.

Relation between volume, density, and temperature. Linear dilatation of solid bodies. Ramsden's instrument. Cubical dilatation of liquids. Dulong and Petit's experiments on mercury. Discussion. Regnault's experiments.

Cubical dilatation of solids and of other liquids when that of mercury is given.

Relations between the volume, density, and elasticity of a gas, and its temperature.

Cubical dilatation of gases. Experiments of Gay-Lussac, Rudberg, and M. Regnault. Advantage of varying the methods of experimenting in these delicate researches.

Methods based upon the changes of volume under a constant pressure, and upon the changes of pressure for a constant volume.

The disagreement of these two methods is due to deviations from the law of Mariotte.

The constancy of the co-efficients of dilatation previously defined is only approximately true.

Necessity of employing two different co-efficients of dilatation according as consideration is being had to the variations of volume to a given pressure, or of pressure to a given volume.

Empirical formulæ for the dilatation of liquids.

Graphical constructions.

Lesson 10.

Thermometers.

Construction of thermometers. Mercurial thermometer. Details of construction. Fixed points. Different scales; their relation. Arbitrary scales. Change which takes place in the zero point. Different precautions to be observed in using the mercurial thermometer.

General want of comparability of mercurial thermometers with tubes of different material.

Air thermometers. They are comparable with one another within the limits of the errors of experiment, whatever the nature of the tube employed. This property entitles the air thermometer to a preference for all accurate measures. Comparison of the air and mercurial thermometers.

THERMOSCOPE, DIFFERENTIAL THERMOMETER, PYROMETERS, BREGUET'S THERMOMETER.

Lessons 11—13.

Changes of State produced by Heat.

Exposition of the phenomena which accompany the liquefaction of solids and the solidification of liquids. Constancy of the temperature whilst the phenomenon is going on.

Sudden melting and freezing. Persistance of the liquid state beneath the melting point.

Influence of pressure.

Exposition of the phenomena which accompany the conversion of liquids or solids into vapour, and the inverse passage from the gaseous to the liquid or solid state. Constancy of the temperatures whilst the phenomenon is going on.

Influence of pressure.

Phenomena of ebullition in free space. Augmentation of the temperature and pressure in a confined space. Papin's digester.

Properties of vapours in spaces and in gases. Saturated vapours. Their tension does not depend upon the space which they occupy, but only upon their temperature.

Effects of a diminution or increase of pressure without change of temperature; the same without change of pressure. Effects of lowering the temperature in a limited region of space occupied by vapour.

Tension of a saturated vapour at the boiling point of its liquid.

Measure of the tensions of the vapour of water. Experiments of Dalton, Gay-Lussac, Dulong, and Arago, and of M. Regnault.

Tables of the tensions of steam. Empirical formulæ. Graphical constructions.

It is assumed that non-saturated vapours are subject to the same laws as gases.

APPLICATIONS. CORRECTION OF THE BOILING POINT IN THE CONSTRUCTION OF THERMOMETERS. BAROMETRICAL THERMOMETERS.

Lessons 14—16.

Various Applications of the Laws previously established.

A phenomenon cannot always be separated from the accessory phenomena which concur with it in producing the final result. Necessity of corrections to render complex results comparable *inter se.*

Density of solids when regard is had to the temperature and weight of the gases displaced by them.

Precautions to be attended to in the experiments. Empirical formulæ for the density of liquids. Maximum density of water. The temperature corresponding to the maximum must be determined graphically, or by interpolation.

Corrections for measures of capacity, for barometric measures.

The uncertainty of the corrections cannot, in any considerable degree, affect the densities of solids and liquids.

Density of gases. Biot and Arago's experiments. Special difficulties of the question. The uncertainty of the corrections may sensibly affect the results. Regnault's method.

The same method may be applied to the determination of the co-efficient of dilatation for gases.

Density of vapours. Definition founded on the hypothetical application of the same laws to gases and vapours. Formulæ. Experimental method of Gay-Lussac and of Dumas. Corrections. Comparison of the two methods. Necessity of conducting the experiments at a distance from the saturation point. Latour's experiments. Relations between the weight and volume of a gas, and its temperatures; between the weight and volume of a gas mixed with vapours, and its temperature. Various problems.

Hygrometry. Chemical hygrometry. Hygrometry by the dew-point. Psychrometry.

PROPAGATION OF HEAT.

Lessons 17, 18.

Propagation at a Distance.

Rapid propagation of heat at a distance, in vacuum, in gases, in certain liquid or solid mediums. Experiments which establish this.

Rays of heat. Velocity of propagation. Intensity of heat received at a distance. Intensity of heat received or emitted obliquely. Emitting power, power of absorption, reflexion, diffusion. The emitting and absorbing power are expressible by the same number in terms of their proper units respectively.

Analysis of calorific radiations by absorption. Different effects of deathermanous or thermochroic medium. Different influences of increasing thicknesses of the combination of different mediums. Radiations proceeding from different sources various effects of different mediums on these radiations.

The calorific radiations emanating from different sources, have all the characters of differently coloured heterogeneous rays of light.

APPENDIX F.

Physics.
First Year.

THEORY OF RADIATION AND OF THE DYNAMICAL EQUILIBRIUM OF TEMPERATURES. APPARENT REFLEXION OF COLD.

Lesson 19.

Law of Cooling.

Definition of the rate of cooling. Many causes may conspire in the cooling of a body. Cooling in space. Newton's law only an approximation. Experimental investigation of the true law. Method to be followed in this investigation. The velocity of cooling is not a *datum* directly observable. It must be deduced provisionally from an empirical relation between the temperature and the time. Preliminary experiments. Course of the definitive experiments. Elementary experimental laws.

Hypothetical form of the function which expresses the velocity of cooling. To determine by means of the preceding experimental laws the unknown form of the function which expresses the law of radiation. Relation between the temperatures and the times. This relation only contains data immediately observable, and may be verified *à posteriori*.

The contents which enter into the preceding relation depend upon thermometric constants and the nature of the radiating surface.

The contact of a gas modifies the law of cooling.

Lessons 20, 21.

Propagation by Contact.

Slow propagation of heat in the interior of bodies, in solids, liquids, and gases. Confirmatory experiments. Hypothesis of partial radiation. Theoretical law resulting from this hypothesis upon the decrease of temperatures in a solid limited by two indefinite parallel planes maintained at constant temperatures. Determination of the co-efficient of conductibility by the experimental realization of these conditions. This experiment determines a numerical value of the co-efficients; it is not of a nature to serve as a check upon the theoretical principles. Enunciation of the law resulting from the same theoretical principles upon the decrease of temperatures in a thin bar heated at one end.

CALORIMETRY.

Lessons 22, 23

Specific Heats.

Comparison of the quantities of heat. The quantities of heat are not proportioned to the temperatures. Definitions of the unity of heat. General method of mixtures to estimate the quantities of heat. Experimental precautions and corrections.

Application of the general method of mixtures. Specific heats of solids and liquids. Law of the specific heat of atoms. Heat absorbed by expansion, restored by the compression of bodies. Experiments on gases. Specific heats of gases under constant pressure. Measure of specific heats of gases under constant pressure Special difficulties of the question. Succinct indication of one of the methods. Specific heats to a constant volume.

Lesson 24.

Latent Heat.

Component heat of liquids absorbed into the *latent* state during fusion, restored to the *free* state during solidification.

Influence of the viscous state. Latent heat of ice. Ice calorimeter; its defects.

Component heat of vapours, absorbed into the latent state during vaporization, restored to the free state during condensation. Measure of the latent heat of vapours. Regnault's experiments.

Empirical laws on the latent heat of vaporization.

Applications of Calorimetry.

Means of producing heat or cold; 1, by changes in density; 2, by changes of state. Freezing mixtures. Vaporization of liquids. Condensation of vapours.

Steam boilers. Warming by hot air and hot water. Various problems. Sensations produced by a jet of vapour.

Different physical and chemical sources of heat; percussion, friction, chemical combinations, animal heat, natural heat of the globe, solar heat, &c. It will be remarked that mechanical work may become a source of heat, and heat a source of mechanical work.

STATICAL ELECTRICITY.—MAGNETISM.

STATICAL ELECTRICITY

Lessons 25—27

General phenomena. Distinction of bodies into conductors and non-conductors. Distinction of electricity into two kinds. Separation of the two electricities by friction. Hypothesis of electric fluids. Effects of vacuum of gases and vapours of points. Electrical attractions and repulsions. Electrization by influence. Case where the influenced

body is already electrized. Sparks; power of points. Electrization by influence preceding the motion of light bodies.

Electroscopes.

Electrical machines of Van-Marum, Nairne, Armstrong.

Condenser. Accumulation of electricity upon its surface. Leyden jar. Batteries. Electrical discharges. Effects of electricity.

Condensing electroscope. Electrophorus.

Velocity of statical electricity.

Atmospherical electricity. Phenomena observed with a serene sky. Electricity of clouds. Storms. Lightning. Thunder. Effects of thunder. Return-shock. Lightning conductor.

Different sources of statical electricity.

Magnetism.

Lessons 28—30.

Natural magnets. Action upon iron and steel. Artificial magnets. The attractive action appears as if it were concentrated about the extremities of magnetic bars. First idea of poles.

Direction of a magnetised bar under the earth's action. Reciprocal action of the poles of two magnets. Names given to the poles.

Phenomena of influence. Action of a magnet upon a bar of soft iron; upon a bar of steel. Coercive force. Effects of the rupture of a magnetised bar. Theoretical ideas on the constitution of magnets. More precise definition of the poles.

Action of the earth upon a magnet. The earth may be considered as a magnet. Its action may be destroyed by means of a magnet suitably placed. Astatic needles. The magnetic action of the earth is equivalent to a *couple*. Three constants define the couple of terrestrial action. Declination. Inclination. Intensity. Measure of the declination; of the inclination.

Magnetic metals. Influence of hammering, tempering, &c. Methods of magnetising. Saturation. Loss of magnetism. Influence of heat. Magnetic lines. Armatures.

Magnetisation by the earth's influence. Means of determining the magnetic state of a body.

Measure of Magnetism and Electricity.

Lessons 31, 32.

Coulomb's balance. Distribution of magnetism on a magnetised bar; distribution of electricity at the surface of isolated conductors. Comparative discussion of the conditions of the two problems and the methods of experiment.

Laws of the magnetic attractions and repulsions. Law of electric attractions and repulsions. Comparative discussion of the conditions of the two problems, and the methods of experiment.

Determination of the law of magnetic attractions and repulsions by the method of oscillations.

Comparison of the magnetic intensity at different points of the earth's surface

Lessons 33, 34.

Revision.

Considerations on the totality of the subjects of the course.

SECOND YEAR.

Dynamical Electricity.

Galvanism.

Lessons 1, 2.

Chemical sources of electricity. Experimental proofs. Arrangement devised by Volta to accumulate, at least in part, at the extremities of a heterogeneous conductor the electricity developed by chemical actions.

Pile. Tension at the two isolated extremities; at one single isolated extremity; at the two extremities reunited by a conductor. Continuous current of electricity. Poles. Direction of the current, &c.

Various modifications of the pile of Volta. Woollaston's pile, Münch's pile, &c. Dry piles; their application to the electroscope.

Principal effects of electricity in motion, and means of making the currents perceptible Experiment of Oersted. Galvanoscopes.

Currents produced by heat in heterogeneous circuits. Thermo-electric piles. Thermometric graduation of thermo-electric piles.

Currents produced by the sources of statical electricity.

APPENDIX F.

Physics
Second Year.

Properties of Currents.

Lesson 3.

1.—*Chemical Actions.*

Definitions. Phenomena of decomposition and transference. Reaction of the elements transferred upon electrodes of different kinds.

Principles of electrotyping.

Causes of the variation of the current in ordinary piles; means of remedying this; Daniell's pile. Bunsen's pile.

Lessons 4—8.

2.—*Mechanical Properties.*

Reciprocal actions of rectilinear or sinuous currents parallel or inclined. Reaction of a current on itself.

Reciprocal actions of helices or solenoids. Continuous rotation of currents by their mutual action; by reaction. Analogy of magnets and solenoids. Electro-dynamical theory of magnetism. Action of magnets upon currents and solenoids. Action of currents upon magnets. Experiments of Biot and Savart. Continual rotation of a current by a magnet; of a magnet by a magnet.

Action of the earth upon currents; it acts as a rectilinear current directed from east to west, perpendicularly to the magnetic meridian.

Continual rotation of a current by the action of the earth.

Astatic conductors.

Lessons 9, 10.

3.—*Magnetic Properties.*

Action of an interposed conductor upon iron filings.

Electro-magnets. Magnetization temporary or permanent. Principles of the electric telegraph. Electrometers. Reference to diamagnetic phenomena.

4.—*Electro-motive Properties.*

Phenomena of induction by currents, by magnets. Phenomena of magnetism in motion. Induction of a current upon itself.

Induction of different orders.

Interrupted currents. Clarke's machine.

Lesson 11.

5.—*Calorific Properties.*

Influence of the nature of the interposed conductor; of its section; of the intensity of the current. Unequal temperatures at the different junctions of a heterogeneous circuit.

6.—*Luminous Properties.*

Incandescence of solid conductors. Spectrum of the electric light. Voltaic arc. Transfer of ponderable matter. Action of the magnet upon the Voltaic arc.

7.—*Physiological Action of Currents.*

Some words on this subject. Muscles and nerves. Actions of discontinuous currents. Reotomic contrivances.

Reometry.

Compass of sines, of tangents. Experimental graduation of galvanometers.

The dynamical intensity of a current diminishes when the length of a current increases. Reostat.

Laws of the dynamical intensity of a current in a homogeneous circuit. Reduced length and resistance of a circuit. Specific co-efficients of resistance. Laws of the dynamic intensity of a current in a heterogeneous circuit.

The intensity of currents is in the inverse ratio of the total reduced length, and proportional to the sum of the electromotive forces. Formula of the pile. Discussion of the case of hydro-electric piles—thermo-electric piles. Conditions for the construction of a pile, with reference to the effects to be produced. Conditions for the construction of a galvanometer with reference to its intended application.

Laws of secondary currents in the simplest cases. The chemical intensity of a current is proportional to its dynamical intensity.

Acoustics.

Lessons 12—15.

Noise, sound, quality of the sound, pitch, intensity, *timbre*. A state of vibration in a solid, liquid, or gaseous body is accompanied with the production of sound.

The pitch depends on the number of vibrations. Unison. Instruments for counting the vibrations: 1st. Graphic method. 2d. Toothed wheels. 3d. Lever. Feeling of concord. Musical scale. Gamut. Limit of appreciable sounds.

Study of vibrating motions in solids. Vibrating cords. Vibrations transversal, longitudinal. Experimental laws. Sonometer.

Spontaneous division of a cord into segments. Fundamental sounds. Harmonic sounds.

Straight and curved rods. Transversal and longitudinal vibrations. Experimental laws. Division into segments. Nodes. Ventral segments. Membranes.

Plane and curved plates. The vibrations divide them into "*concamerations.*" Nodal lines. Harmonic sounds.

Study of the vibrations in liquids and in gases.

Theoretical ideas upon the propagation of a vibratory motion in indefinite elastic media, on an indefinite cylindrical tube. Waves of condensation, of dilatation. Progressive nodes and ventral divisions. Laws of the intensities of sound. Direct measure of the velocity of the propagation of sound in water. Measure of the velocity of the propagation of sound in air. Formulæ without demonstration. Comparison of the formulæ with experiment.

Sonorous waves reflected in an indefinite medium.

Fixed nodes and ventral divisions. Sonorous waves reflected in closed and open tubes. Fixed nodes and ventral divisions; the vibratory state and density thereat.

Series of sounds afforded by the same tube. Effect of holes.

Sonorous reflected waves in rods. Series of sounds afforded by the same rod vibrating longitudinally. Indirect measure of the velocity of sound in gases, liquids, and solids.

Experiments on the communication of vibrating motion in heterogeneous mediums, on the general direction of the vibrating motion communicated.

Intensification of sounds. Interferences. Beats. Different stringed and wind instruments. Means of setting them in vibration.

A few words on the organs of voice and hearing. Incompleteness of our knowledge on this subject.

Optics.

Lessons 16, 17.

Propagation of Light.

Propagation of light in a straight line. Rays of light. Geometrical theory of shadows. Velocity of light. Rœmer's observations. Laws of intensity of light. Photometers of Bouguer, Rumford. Intensity of oblique rays. Comparison of illuminating powers. Total brightness. Intrinsic brightness.

Reflexion.

Reflexion of light: its laws. Experimental demonstration. Images formed by one or more plane mirrors. To ascertain if a looking-glass has its two faces parallel.

Spherical mirrors. Foci, formulæ. Discussion. Images by reflexion. Measure of the radius of a spherical mirror.

Definition of caustics by reflexion. Definition of the two spherical aberrations in mirrors.

Woollaston's goniometer.

Lesson 18.

Refraction.

Refraction of light in homogeneous mediums. Descartes' law. Experimental demonstration for solids and liquids.

Inverse return of the rays. Successive refractions. Indices of transmission in terms of the principal indices. Consequences of Descartes' law. Total reflexion. Manner of observing it.

Irregular refractions. Mirage.

Refraction is always accompanied with the accessory phenomenon of dispersion.

Geometrical consequences of the law of refraction. Focus of a plane surface. Focus of a medium bounded by two parallel plane surfaces; by two plane surfaces inclined in the form of a prism.

Foci of a spherical surface; of a medium limited by two spherical surfaces. Lenses.

Formula for lenses. Discussion. Varieties of lenses. Optic centre. Images. Measure of the focal distance of lenses.

Definition of caustics by refraction. Definition of the two spherical aberrations of a lens.

Lessons 19, 20.

Dispersion.

Unequal refrangibility of the differently coloured rays which compose white light. Analysis of heterogeneous light by the prisms. Newton's method. Solar spectrum. Homogeneity of the different colours. Second refraction of a homogeneous pencil. Experiment with crossed prisms. Precautions to be attended to in the experiments. The spectrum, obtained by Newton's method, differs from the spectrum produced at the focus of a lens placed between the prism and the picture, according to the method of Fraunhofer. Reasons of the comparative purity of this latter spectrum. Fraunhofer's lines. Different spectra of different sources of heterogeneous light. Marginal iridescence

APPENDIX F.

Physics.
Second Year.

of a large pencil of natural light traversing a prism. Dispersion of light by lenses. Iridescence of focal images. Recomposition of light, by means of a prism at the focus of a spherical mirror or a lense, by the rapid rotation of a plane mirror, by the rotation of a disk with particoloured sectors. Compound colours.

Chemical and calorific radiations accompany luminous radiations.

Analysis of light by absorption. Characteristic action of transparent coloured mediums upon different sorts of compound light. Different influences of increasing thickness. Effects of differently coloured mediums upon heterogeneous light. Effects of differently coloured mediums upon homogeneous rays separated by the prism.

Lesson 21.

Measure of the Indices of Refraction.

Determination of the indices of refraction.

1. In solids. Measure of the refracting angles. Minimum of deviation. Measure of the corresponding deviation. Use of Fraunhofer's lines.

2. In liquids.

3. In gases. Special difficulties of the question. Experimental method. Biot's and Arago's experiments.

Any power whatever of the index of refraction diminished by unit is sensibly proportional to the density of the gas. Method of Dulong founded on this remark.

Lessons 22, 23.

Application of the preceding Laws.

Rain-bow. Different orders of bow.

Achromatism.

Achromatic prisms. Diasperometer achromatism of lenses; how to verify it. Definition of secondary spectra: their nature gives the means of recognizing, whether flint or crown glass predominates, in an imperfectly achromatic lens.

Instruments essentially consisting of an achromatic lens. Magic lantern; megascope; solar microscope; camera obscura; collimators.

Vision.

Summary description of the principal optical parts of the eye. They act like the lens of a camera obscura to form an image upon the retina. Distinct vision; optometers; short sight; long sight; spectacles.

Binocular vision; perspective peculiar to each eye; estimation of distances; sensation of solidity; stereoscope; estimation of magnitudes.

Persistence of Impressions; divers Experiments.

Lessons 24, 26.

Optical Instruments.

Camera lucida. A lens is necessary to reduce to the same apparent distance the two objects seen simultaneously. Instruments to assist the sight; simple microscope; the magnifying power; distinctness; field; advantage of a diaphragm; it modifies the field and the brightness variously according to its position.

Woollaston's double glass; its advantages.

General principle of compound dioptrical instruments.

Compound microscope; experimental measure of its magnifying power, by means of the diaphragm, by means of the camera lucida.

Astronomical telescope; object glass; simple eye-glass. Necessity for a diaphragm; its place; the wires, their place; optic axis of a telescope. Parallax of the threads of the wires; magnifying power of the object-glass; of the eye-glass; field of view of a telescope.

Optic ring; different methods of measuring the magnifying power.

Distinctness of a telescope; night-glass.

Different distances of drawing out the eye-glass for short-sighted and long-sighted observers.

Different sorts of eye-pieces; positive eye-pieces; ordinary double eye-piece of the astronomical telescope. Ramsden's eye-piece; treble eye-piece of the terrestrial telescope. Negative eye-pieces; simple eye-piece of Galileo. Compound *ditto* of Huyghens; advantages and disadvantages of these different combinations; general principle of catadioptrical instruments.

Lessons 27—29.

Double Refraction.

Crystallised mediums do not all act upon light like homogeneous mediums.

Double refraction of Iceland spar; the extraordinary image turns round the ordinary image. The ordinary and extraordinary rays cross at the interior of the crystal.

Huyghens' construction ; measure of the ordinary and extraordinary indices of refraction ; attractive and repulsive crystals ; a ray falling perpendicularly does not always bifurcate in a camera with parallel faces, nor in a prism. Definition of uniaxial and biaxial crystals.

The dispersion of the ordinry ray differs from that of the extraordinary ray.

The two rays are unequally absorbed in many coloured mediums. Tourmaline.

Doubly-refracting prisms ; their construction. Use of doubly-refracting prisms to measure apparent diameters, &c.

Lessons 30, 31.

Polarization.

Successive refractions in doubly-refracting prisms. Special properties of the two rays emerging from the first doubly refracting crystal. Polarisation by double refraction.

Reflection from transparent media polarizes the light partially or wholly according to the incidence. Brewster's law. Reflection of polarized light from a transparent medium.

Simple refraction partially polarizes the light. Many successive refractions polarize it almost totally. Piles of glasses.

Different methods to obtain a ray of polarized light, 1st, by reflection ; 2nd, by simple refraction ; 3rd, by double refraction, by eliminating one of the refracted pencils ;—by a screen,—by total reflexion, Nicol's prism, by absorption, tourmaline.

Distinctive characters of light completely or partially polarized.

Lessons 32—34.

Theory of Undulations.

Hypothesis of luminous undulations.

Vibratory state of a simple ray of homogeneous light. Vibratory state at the intersection of two simple rays of homogeneous light intersecting at a very small angle.

Experimental proofs in support of this hypothesis :

1st. Experiment with interferences, fringes. Their breadth is different for different colours ; they give the various colours of the prism in white light. The alternately bright and dark sheets are hyperboloids of revolution. The measure of the fringes gives the means of estimating the lengths of the undulations corresponding to different colours.

2nd. Coloured rings of Newton, observed by reflection, by refraction. Law of the diameters ; these vary in absolute length for different colours. Variously coloured rings with white light. Reflected rings with a white spot at the centre.

The theory of the undulations does not apply merely to these phenomena. Explication of the laws of reflection and refraction. Definition of polarization in the system of waves. Elementary application of double refraction and the polarization which accompanies it in uniaxial crystals when the face of the crystal is parallel to the axis, and the plane of incidence normal or parallel to this axis.

Chemical and Calorific Radiations.

Chemical and calorific radiations are subject, like luminous radiations, to the laws of reflection, refraction, dispersion, double refraction, polarization, interferences.

Lessons 35, 36.

Revision.

Considerations on the totality of the subjects of the course.

MANIPULATIONS IN PHYSICS.

The practical exercises which constitute the subject of this programme will be performed in part by the pupils under the direction of the professors and *répétiteurs*, in part by the professors and *répétiteurs* with the co-operation of the pupils.

First Year.

Use of various instruments, designed for measuring lengths. Experiments on weight with Atwood's machine, the inclined plane, Morin's apparatus, and the pendulum.

Some experiments on elasticity.

Various verifications of the principles of hydrostatics and hydrodynamics.

Construction of aerometers.

Construction of a barometer, of a manometer. Various verifications of the law of Mariotte.

Various experiments with the air-pump.

Determination of the density of solids or liquids by different methods.

APPENDIX F.

Physics. Second Year.

Construction of a thermometer.

Experiments on the dilatation of liquids and solids by means of the ordinary thermometer and by means of the statical thermometer.

Experiments upon the dilatation of air by various methods.

Experiments upon the tension of vapours by different methods.

Determination of the density of vapours and gases by various methods.

Leading experiments on calorific radiation.

Experiments on cooling.

Determination of specific heats, heats of fusion, heats at which bodies pass into vapour.

Cooling mixtures.

Use of the chemical hygrometer, the wet-bulb hygrometer.

Rehearsal of the leading experiments on magnetism.

To magnetize a needle, to reverse its poles.

Rehearsal of the principal experiments of statical electricity.

Experiments verificatory of the laws of electricity and magnetism.

Use of compasses.

SECOND YEAR.

Experiments upon the chemical actions of poles.

Leading experiments in electro-dynamics.

Leading experiments upon the magnetic properties of currents.

Experiments on induction.

Experiments on the calorific and luminous actions of currents.

Quantitative experiments on the laws of currents.

Experiments on the propagation of sound; on the vibrations of rods of plane or curved plates, membranes, sonorous tubes.

Experiments on mirrors, plane or curved.

Experiments on lenses.

Experiments on the decomposition of light by the prism—by absorption.

Measures of the indices of the refraction of solids.

Use of the magnifying glass and microscope; measure of the magnifying power.

Use of different telescopes, with and without corrections. Measure of the magnifying power.

Experiments on double refraction and polarisation.

Experiments on interferences and coloured rings.

APPENDIX G.

LIST OF THE PRESENT EDUCATIONAL STAFF OF THE POLYTECHNIC SCHOOL.

Director of Studies	Riffault, Lieutenant-Colonel of Engineers.
Examiners of Students	Mathieu, of the Academy of Sciences. Lamé, „ Cahours. Babinet, „ Verdet.
Examiners for Admission	Didion, Colonel of Artillery, President. Lefébure de Fourcy. Hermite. Serret. Wertheim.
Professors of Analysis	Bertrand. Duhamel, of the Academy of Sciences.
„ of Mechanics	Belanger, of the Roads and Bridges. Delaunay.
„ of Descriptive Geometry	Delagournerie, „
„ of Physics	Jamin. Bravais, Lieutenant in the Navy.
„ of Chemistry	Regnault, of the Academy of Sciences. Fremy.
„ of Military Art and Fortification	Favé, Lieutenant-Colonel of Artillery.
„ of Geodesy	Vacant.
„ of Architecture	Reynaud.
„ of French Composition	Havet.
„ of German	Bacharach.
„ of Drawing	Cogniet.
Drawing Master for Figure and Landscape	Lalaisse. Canon. Colin.
Drawing Masters for Machinery	Tronquoy.
Superintendent of Drawings	Bardin.
Répétiteurs	Jodot De Lomenie. Fix. Bary. Transon. Bonnet. Leblanc. Bresse. Cloëz Cabart-Dameville. De Launedat. Quiquandon. Haton. Bonnamy, Captain of Engineers.
Extra Répétiteurs	Briot. Leroux. Guignet. Vacant.

To this may be subjoined (from the Catalogue given in the *Répertoire de l'Ecole Polytechnique,*)

A List of some of the most Distinguished Pupils of the Polytechnic School.

Name.	Age at Admission.	Years		Service chosen on Leaving.	Subsequent Services and Position.
		Of Entering.	Of Leaving.		
Arago -	19	1803	1807	Public Instruction - -	Professor at the School, Member of the Institute, &c. &c. Died 1853.
Atthalin -	18	1802	1804	Engineers - - - -	General of Division, Sub-Inspector of Studies in the School.
Babinet -	18	1812	1813	Artillery. Public Instruction.	Examiner of Students at the School. Member of the Academy.
Bachasson de Montalivet.	19	1820	1822	Ponts et Chausées - -	Minister of Interior.
Barante (De)	16	1798	1801	Withdrew - - - -	Prefect, Ambassador, &c. Member of the Academy.
Bardin - -	19	1813	1815	Artillery. Public Instruction.	Professor at Metz, *Chef des Travaux Graphiques* at the School.
Becquerel -	18	1806	1808	Engineers. Public Instruction.	Member of the Institute, Professor in the Museum of Natural History.
Belanger -	18	1808	1810	Ponts et Chaussées. Public Instruction.	Professor in the School.
Bernard -	18	1794	1796	Engineers - - - -	Lieutenant-General, Minister of War, &c.
Besançon	17	1802	1803	Withdrawn.	Professor of Mathematics at St. Cyr.
	21	1805	1806	Infantry. Public Instruction	*Répétiteur* at the School.
Bineau - -	19	1824	1826	Public Instruction.	*Répétiteur*, Examiner, and Inspector of Studies at the School, Professor at the Collége de France, Member of the Institute.
Binet -	18	1804	1806	Ponts et Chausées. Public Instruction.	Examiner for admission to the School, Professor at the Collége de France, Member of the Institute.
Biot - -	20	1794	1795	Ponts et Chaussées. Public Instruction.	Professor of Mathematics at St. Cyr, and *Répétiteur* at the School.
Boacharlat -	21	1794	1795	Withdrew. Public Instruction.	Examiner for admission to the School. Retired Inspector General of the University. Died in 1853.
Bourdon -	17	1796	1800	Withdrew. Public Instruction.	Doctor of Medicine, Professor of Chemistry at the *Ecole de Pharmacie.*
Busey - -	19	1813	1815	Withdrew. Public Instruction.	*Répétiteur*, then Professor of Mathematics at the School, Member of the Institute, Professor of the Faculty of Sciences.
Cauchy - -	16	1805	1807	Ponts et Chaussées. Public Instruction.	Became Captain in the Zouaves, afterwards in the Staff; retired in 1852 as General of Division; Minister of War, and Chief of the Executive in 1848.
Cavaignac -	18	1820	1822	Engineers, 1837. Infantry Staff.	Professor of Geodesy and Machinery at the School, Member of the Institute, Professor of the Faculty of Sciences.
Chasles - -	19	1812	1815	Declined appointment. Public Instruction.	Professor of Mathematics.
Chuvoin -	19	1836	1837	Withdrew. Public Instruction.	Professor at the Collége de France, Member of the Institute.
Chevalier (Michel)	17	1823	1825	Mines - - - -	Retired General of Division, Minister of War, Minister of Marine, President of the Councils of the School.
Clermont-Tonnerre (de)	20	1799	1802	Artillery - - - -	"Répétiteur" ae the School, Examiner for Admission.
Comte - -	16	1814	1816	Withdrew. Public Instruction.	
Considérant -	18	1826	1828	Engineers.	
Delaunay -	18	1834	1838	Mines - - - -	Professor at the School.
Dinet - -	19	1794	1797	Geographical Corps. Public Instruction,	Examiner at the School. Retired Inspector-General of the University.
Doulat de Pontecoulant	16	1811	1813	Artillery. Staff - -	Retired Colonel in 1849.
Ducos de la Hitte	18	1807	1809	Artillery - - - -	General of Division, Minister of Foreign Affairs, President of the Consulting Committee for Artillery.
Duhamel -	17	1814	1816	Withdrew. Public Instruction.	*Répétiteur*, Professor, Examiner, and Director, of Studies in the School, Member of the Institute.
Dulong - -	16	1801	1802	Withdrew. Public Instruction.	Examiner, Professor, and Director of Studies at the School, Member of the Institute; died in 1838.
Dupin - -	17	1801	1803	Public Instruction - -	Professor at the Arts et Métiers, Minister of Marine, Member of the Institute.

Name.	Age at Admission.	Years. Of Entering.	Years. Of Leaving.	Service chosen on Leaving.	Subsequent Service and Position.
Elie de Beaumont	19	1817	1819	Mines	Professor at the School of Mines and at the Collége de France. Member of the Institute.
Francœur	21	1794	1797	Geographical Corps. Artillery. Public Instruction.	Examiner of Admission to the School. Professor in the Faculty of Sciences.
Gay-Lussac	18	1797	1800	Ponts et Chaussées. Public Instruction.	Professor at the School and in the Faculty of Sciences. Member of the Institute.
La Monière	18	1824	1826	Engineers	Passed into the Infantry. The Staff. Retired General of Division.
Le Chevalier	18	1813	1815	Artillery. Public Instruction.	Professor of Natural Philosophy at the School.
Le Verrier	20	1831	1833	Tobacco. Public Instruction.	*Répétiteur* of Geodesy at the School. Member of the Institute.
Lionville	16	1825	1827	Ponts et Chaussées. Public Instruction.	Professor at the School and at the Collége de France. Member of the Institute.
Malus	19	1794	1796	Engineers	Died as Director of Studies of the School. Member of the Institute. Was in the expedition to Egypt.
Mathieu	20	1803	1805	Ponts et Chaussées. Public Instruction.	*Répétiteur*, Professor, and Examiner at the School. Member of the Institute.
Morel	22	1797	1801	Public Instruction. Artillery.	Professor of Mathematics in a School of Artillery. Sub-Inspector at the School.
Morin	18	1813	1817	Artillery	General of Brigade. Member of the Institute.
Petit-Dufresnoy.	19	1811	1813	Mines	Member of the Institute. Professor at the Museum of Natural History.
Piobert	20	1813	1815	Artillery	General of Division. Member of the Institute.
Poinsot	17	1794	1797	Ponts et Chaussées. Public Instruction.	Professor and Examiner at the School. Member of the Institute.
Poisson	17	1798	1800	Public Instruction	Professor and Examiner at the School. Member of the Institute.
Poncelet	19	1807	1810	Engineers	General of Brigade. Commandant of the School from 1848 to 1851. Member of the Institute.
Reech	18	1823	1825	Naval Architects	Director of Studies at the School of Application for Naval Architects.
Regnault	20	1830	1832	Mines	Professor at the School and at the Collége de France. Member of the Institute.
Serret	19	1838	1840	Artillery. Public Instruction.	Examiner for Admission to the School.
Vaillant	17	1807	1809	Engineers. Staff.	Marshal of France. Commandant of the School in 1839 and 1840. Member of the Institute. Minister of War.

APPENDIX H.

Report to the Emperor.

APPENDIX H.

IMPERIAL DECREE REORGANIZING THE IMPERIAL SCHOOL OF APPLICATION FOR THE ARTILLERY AND ENGINEERS.

REPORT to the EMPEROR on the ORGANIZATION of the IMPERIAL SCHOOL of APPLICATION for the ARTILLERY and ENGINEERS.

Paris, June 24, 1854.

SIRE,

BY a Decree of the 10th July 1852, Your Majesty appointed a Mixed Commission, presided over by a Marshal of France, of Officers of Artillery and Engineers, entrusted with the revision of the Regulation of 5th June 1851, by which the Constitution of the School of Artillery and Engineers was drawn up, as well as the various rules referring to its government and the instruction given at it.

This Commission, of which Your Majesty did me the honour to appoint me President, has just ended its labours; and the Report of them has been sent to me by General De La Hitte, who has taken my place as President since Your Majesty has entrusted me with the Ministry of War.

The work of the Commission is composed of the following documents:—

1. Proposed Decree for the Organization.
2. Regulations of Police.
3. Regulations of Administration.
4. Regulations of the Service of Officers on the Staff.
5. Regulations for the Works to be executed by the Pupils.
6. Regulations on the Value to be attached to these Works.
7. Programme of the Course of Artillery.
8. Programme of Military Art and of Field Fortification.
9. Programme of permanent Fortification, of the Attack and Defence of Places.
10. Programme of Topography.
11. Programme of the Course of Geodesy.
12. Programme of the Course of applied Sciences.
13. Programme of Mechanics.
14. Programme of Construction.
15. Programme of the German Language.
16. Programme of a Sham Siege.
17. Programme of a Course of Veterinary Art.
18. Programme of practical Military Instruction.

Regulations of Organization.

The main part of the work of the Commission consists in the Proposed Decree intended to replace the constitutive Regulations of the 5th June 1851. The object of this Decree is to lay the foundations of the Organization of the School of Application, to define the Body of whom the School is to consist (its Staff, Professors, and other officials), as well as the business of each officer; to establish sound principles, both for the Instruction and the Discipline; and finally to fix the military position of the Pupils, as well as the Rules for classing them on their leaving the School.

The Commission has endeavoured to harmonise the organization of the School with the Laws, Ordinances, Decrees, and Military Regulations now in force. It has undertaken to preserve religiously the improvements which have been gradually introduced, and the use of which has been shown by experience; and it has especially desired to give to the military element the full development which it ought to have in a school exclusively military.

The Commission has throughout endeavoured to keep the above objects in view. It has done this particularly in its Regulations of Police, which are intended, not merely to lay down general rules for the subordination to be observed by the Pupils in their double character of Officers and Pupils, but also to define distinctly the special obligations which they contract by reason of this peculiar position. This position has made it impossible to apply literally to the pupils in all respects the regulations under which officers of the Army are placed, although the Commission has endeavoured to depart as little as possible from these Regulations.

The position of Officers belonging to the Staff of the School, or to the body of Instructors, is also a special one, undefined by any existing directions, and requiring accordingly to be well defined. This is the object of the Regulations of the Service of the Staff of the School.

This new Regulation gives a permanent sanction to an essential modification in the previous system, the object of which is to connect the Captains of the Staff with the instruction, both by attaching them to Professors and by the practical teaching and

directions which they will be called upon to give to the pupils in their out-of-door work. And as the Decree of the Organization of the School confers upon the Military Professors a share in the discipline, the result will be, upon the other hand, a good understanding and a close connexion between the officers specially entrusted with the discipline and those specially entrusted with the instruction, such as is eminently fitted to increase the authority and influence of both. Such are the points in the Regulations which I would bring before the notice of Your Majesty. I proceed to state the point of view under which the Commission has regarded the instruction properly so called.

Instruction.

One leading question affects the whole system of instruction.

Since the School of Application has been instituted to form Officers of Artillery and Engineers, is it desirable to separate the instruction given to the pupils of the two corps, and to look solely to the particular requirements of each?

The Commission has not thought this desirable. Allowing, as a general proposition, that it is well to direct the instruction of young men with a view to the special service for which they are destined, it has argued wisely that there are considerations of a higher kind which decide in favour of giving instruction in common, as far as possible, to the pupils intended for the two corps.

I agree in all respects with the view taken by the Commission. The point of the greatest importance to the success of enterprises undertaken in common by the Artillery and Engineers is, that there should be a perfect understanding between two services which always have to support one another, and sometimes to supply each other's places. The best method of obtaining such an understanding on all occasions, and of securing that unity of view so necessary to the good of the service, is undoubtedly to form the officers of the two services in the same school, and to give them, as far as may be, the same military instruction and principles.

In adopting, however, this fundamental principle, the Commission has thought that it was not desirable to push the application of it beyond a certain point, and it has therefore very wisely kept up a separation with regard to certain lessons and a small number of exercises which have appeared to have a special bearing upon the particular services. It has acted in the same manner in all that concerns the practical part of the military instruction which is to be given to the pupils in conformity with the directions followed in their respective corps.

In examining the Programs of the Courses of Lectures, the Commission has been guided by principles which I think it right to submit to Your Majesty.

The alterations in the basis of the instruction given at the Polytechnic School are one of the principal reasons which have led to a revision of the education at the School of Metz.

A course of Fortification and of Military Art has been introduced at the Polytechnic School, as well as a course of Topography; modifications have been made in the somewhat too theoretical method of teaching Mechanics, and the pupils are now practised in handling arms and in infantry manœuvres.

These various modifications could not but react upon the teaching of the School of Application at Metz. It was necessary to avoid, on the one hand, needless repetitions of the work and the teaching, and on the other not to rely exclusively on the preparatory military instruction given at the Polytechnic School.

The Commission has endeavoured with the utmost care to steer its course between the two rocks; when there was any doubt it has preferred to return again to subjects which formed a part of the course at the Polytechnic rather than to neglect them, and this particularly with regard to the military instruction. I think their course has been right; in fact, it must not be forgotten that the military teaching at the Polytechnic School, however enforced, will be always regarded as secondary, and as such neglected by the pupils, whilst at the School of Metz it is the foundation of everything.

But with regard to the other departments of instruction, the Commission has thought it right to deal with them on a different principle. With respect to such courses as are more especially theoretical, its object has been particularly to avoid going over them again. It has accordingly retrenched certain courses; partly because they were a repetition of previous work, and partly because no practical application could be made of them sufficient to justify their introduction into the Program.

These reductions have enabled them to complete the instruction in certain subjects, the practical or military importance of which has seemed to demand a more full development.

I beg to call Your Majesty's attention to the dispositions of Article 65 of the Decree, by virtue of which any Officers of Artillery and Engineers, promoted from the rank of Non-commissioned Officers, may be authorized, upon their own request, to share in the instruction given at the School of Application.

It has seemed to me that the whole career of education ought to be opened to officers who, being less favoured by fortune than their companions, have not received the same advantages of instruction before entering the Service.

APPENDIX H.

Such, Sire, are the principles which have guided the Commission in the fulfilment of its task; and I submit its labours with confidence to Your Majesty's approbation. I am convinced that the modifications proposed will exercise a beneficial influence, and will have the effect of increasing the high reputation so long enjoyed by the two arms of the Artillery and Engineers—a reputation which they have maintained, with great advantage to our country, in some of the most critical periods of our military history.

I pray Your Majesty to affix your signature to the subjoined proposal for a Decree organizing the Imperial School of Application for the Artillery and Engineers.

(Signed) VAILLANT,
Marshal of France, Minister and Secretary of State for the War Department.

IMPERIAL DECREE for the NEW ORGANIZATION of the IMPERIAL SCHOOL of APPLICATION for the ARTILLERY and ENGINEERS.

St. Cloud, June 24, 1854.

Decree.

NAPOLEON, by the Grace of God and the Will of the Nation EMPEROR OF THE FRENCH, to all present and to come, greeting,—

Having considered the Ordinance of the 5th June 1851, founding the School of Application for the Artillery and Engineers;

Having also considered the Decree of the 10th July 1852, which instituted a mixed Commission charged with the revision of the aforesaid Ordinance;

Upon the Report of our Minister, Secretary of State for the War Department,

We have decreed and do decree as follows:—

TITLE I.—*Foundation of the School.*

Object of the School.

Art. I. The Imperial School of Application for the Artillery and Engineers established at Metz is founded for the purpose of affording to pupils proceeding from the Polytechnic School, who are considered fit to serve in the Artillery and Engineers, the special instruction requisite for these two arms.

TITLE II—*Establishment.*

Section I.—*Staff.*

Staff of the School.

Art. II. The Staff of the School is composed as follows:—

One General of Brigade as Commandant, with a Captain as his Aide-de-camp.
A Colonel or Lieutenant-Colonel as Second in Command, and as Director of Studies.
A Major of Artillery.
A Major of Engineers.
Five Captains of Artillery.
Three Captains of Engineers.
One Surgeon (*Médecin major*).

Art. III. The General in Command and the Officer Second in Command are named by Us, upon the advice of our Minister the Secretary of State for the War Department.

Art. IV. The General in Command is chosen alternately from the Generals of Brigade belonging to the Artillery and belonging to the Engineers; so that the command of the School shall be taken in equal proportion from each of the two services.

The Officer Second in Command is chosen from that arm to which the Commandant of the School does not belong.

The length of the term of command assigned to each arm shall not exceed five years.

Art. V. The Field Officers and Captains attached to the Staff of the School are named by our Minister the Secretary of State for the War Department, and cannot hold their appointments beyond the term of five years, whether or not they have within that time been promoted.

When the Command of the School passes from one arm to the other, the change of the Officer Second in Command follows as a matter of course, and must be made within six months after.

The General in Command must name annually to the Inspector-General of the School those Officers of the Staff whose places will be vacant during the course of the year ensuing upon the inspection.

Art. VI. The General in Command is specially entrusted with the execution of the Ordinances, Decrees, Regulations, and Instructions relating to the School of Application. His authority extends to all parts of the service and instruction. He is in immediate correspondence with our Minister the Secretary of State for the War Department, excepting only in questions of general discipline and public order.

The Officer Second in Command is entrusted, under the authority of the General, with the direction of the studies, with the superintendence, police, and discipline of the pupils, and generally with all the details of the service and administration of the School.

In case of the absence or illness of the General, his duties will be undertaken by the Second in Command. In the absence or illness of the Second in Command, his duties will devolve on the Senior Field Officer. APPENDIX H.

Section II.—*Teachers.*

Art. VII. The Body of Teachers is composed as follows:— Teachers.

1. One Professor of Artillery.
2. One Assistant Professor of Artillery.
3. One Professor of the Art of War and of Field Fortification, who shall also undertake the Course of Military Law and Administration.
4. One Professor of Permanent Fortification, and of Attack and Defence of Places.
5. One Assistant Professor of Permanent Fortification, and of Attack and Defence of Places.
6. One Professor of Topography and Geodesy.
7. One Professor of Sciences applied to the Military Arts.
8. One Professor of Mechanics applied to Machinery.
9. One Professor of Construction.
10. One Assistant Professor of Construction.
11. One Professor of German.
12. One Professor of the Veterinary Art and of Horsemanship.
13. One Assistant Teacher of Horsemanship.
14. One Drawing Master, acting as Head of the Drawing Department.

Art. VIII. The Professor and Assistant Professor of Artillery, the Professor of Physical Sciences applied to Military Arts, the Professor of Mechanics applied to Machinery, and the Professor of the Veterinary Art and Horsemanship, are chosen from Officers of Artillery. The Professor of the Veterinary Art and Horsemanship shall have gone through the courses of the Cavalry School. His Assistant is chosen from Non-commissioned Officers on active service who have gone through the courses of the Cavalry School. The Assistant Professor of Permanent Fortification and of Attack and Defence of Places, the Professor of the Art of War and Field Fortification, the Professor and Assistant Professor of Construction, and the Professor and Assistant Professor of Topography and Geodesy, are chosen from Officers of the Engineers.

Art. IX. The Professors and Assistant Professors are named by our Minister the Secretary of State for the War Department, and chosen from among officers in actual service.

The Professor of German is named by our Minister the Secretary of State for War, upon competition.

The Drawing Master is named by our Minister, the Secretary of State for the War Department, upon the advice of the Superior Council.

Section III.—*Ordinary Officials.*

Art. X. The other Officials attached to the School are:— Officials.

One Treasurer. } Both to have formerly belonged as Officers to the Artillery or
One Librarian. } Engineers.
One Principal Clerk (*Chef de Bureau de l'Administration*).
One Assistant Librarian.
One Artillery Storekeeper (*Garde d'Artillerie*) on active service, entrusted with the material connected with the Artillery.
One Engineers' Storekeeper (*Garde du Génie*) on active service, entrusted with the material connected with the Engineers.
One skilled Mechanic.
One skilled Lithographer.
One Fencing Master.
Clerks and Draughtsmen as required.

Art. XI. The Treasurer, Librarian, Assistant Librarian, Secretary, Lithographer, and Mechanic are named by our Minister the Secretary of State for the War Department.

Art. XII. The subordinate Officials are chosen from old soldiers. They are appointed, and in case of serious offences discharged, by the General in Command. Their salaries are subject to the approval of our Minister the Secretary of State for the War Department.

Art. XIII. The Officials employed in the School give up their places on reaching the age of 70.

Title III. *Section* I.—*Councils.*

Art. XIV. The School has two Councils:— Councils

1. A Superior Council.
2. A Administrative Council.

APPENDIX H.

The Superior Council.

Art. XV. The Superior Council consists of the following Members :—
The General in Command of the School, President.
The Officer Second in Command, Director of Studies.
The Major of Artillery (irremoveable), Vice-President.
The Major of Engineers (do.)
Two Captains of the Staff, one of each arm (removeable).
Two Military Professors, one of each arm (do.)
One Captain of the Staff, Secretary (do.)

The Council meets on the summons of the General in Command.

Art. XVI. The removable portion of the Council is renewed every year at the period of the General Inspection. For this purpose, the Inspector-General of the School presents every year to our Minister the Secretary of State for the War Department, the list of the three Captains of the Staff and the three Professors whom he proposes as Members of the Council the ensuing year. The Members are re-eligible.

Art. XVII. The Commandant of the School supplies provisionally any vacancies created in the Council by the temporary absence or by the departure of a Member. In the latter case, the approval of our Minister the Secretary of State for the War Department is necessary to render the nomination of the new Member definitive.

Art. XVIII. The Officers of the Staff, the Professors, and Assistant Professors, who are not Members of Council, may be called upon by the President to attend it for consultation, without the right of voting.

Art. XIX. The duties of the Superior Council are,—

1st. To lay before our Minister the Secretary of State for the War Department, time tables of the work of the School, and to introduce into these tables any alterations which are considered desirable.

2d. To propose any alterations which it considers desirable in the Regulations relating either to the studies or the discipline of the School.

3d. To settle the budget of the School proposed by the Administrative Council. The budget proposed is forwarded by the General in Command of the School, with his observations on it, to our Minister the Secretary of State for the War Department.

4th. To form at the close of the year the classification of the pupils of both arms resulting from the notes assigned to them in consideration both of their conduct and their theoretical and practical instruction.

5th. To name to the Jury of Examination those pupils in whose case it will be necessary that the year's course of study should be repeated.

Art. XX. The resolutions of the Council which determine only the arrangements for the ordinary course of the School may be put into execution upon the order of the General in Command. No other proposals can be carried into effect until they have received the approval of our Minister the Secretary of State for the War Department.

Art. XXI. At the end of each half-year the Report of the Officer Second in Command on the progress of the instruction and on the character of the exercises worked by the pupils is read to the Council. This Report is forwarded, with the observations of the Council, to our Minister the Secretary of State for the War Department.

Council of Instruction.

Art. XXII. When it is requisite to examine any questions relative to the instruction of the School, the Superior Council converts itself into a Council of Instruction by calling in those of the Military Professors who are not already members of it. These Professors vote.

Art. XXIII. The duties of the Council thus constituted are as follows :—

1st. To propose for the courses and the programs every improvement which experience suggests.

These proposals are submitted to the Jury of Examination, and for the approval of our Minister the Secretary of State for the War Department.

2d. To determine any modifications which it may be requisite to make in the amount of value attached to the different courses, consistently with the principles adopted in the Regulations on the amount of value to be attached to the work done by the students, "*l'évaluation des travaux.*"

3d. To draw up a statement with a view to the formation of the annual budget, of the printing, the purchases, and the construction of models required for purposes of instruction.

Art. XXIV. A record of the proceedings of the sittings of the Superior Council will be entered in a register to be kept in the archives of the School, and will be addressed to our Minister the Secretary of State for the War Department.

Section III.—*Administrative Council.*

Administrative Council.

Art. XXV. The Administrative Council consists of—
The Officer Second in Command as President.
The Major of Artillery.
The Major of Engineers.
One Captain of the Staff.
One Military Professor.

And the Treasurer as Secretary, without the right of voting.

Administrative Council.

The Captain of the Staff (who is selected from the arm to which the Second in Command does not belong) and the Professor are named each year by the Inspector General. They may be re-appointed.

Vacancies occurring in the course of the year are filled up by the General Commandant of the School.

Art. XXVI. The Council is entrusted,—

1. With the details of the administration and the accounts.
2. With superintending the employment of the funds granted for the different expenses of the School, in accordance with the arrangements sanctioned by our Minister the Secretary of State of the War Department.
3. To act for the School in all cases of contracts, purchases, and delivery. All contracts are subject to the approval of the General in Command of the School.
4. To draw up, verify, and sanction the inventories.
5. To draw up the scheme of the budget of the School, in accordance with the data laid down by the Council of Instruction.

Art. XXVII. The Administrative Council is summoned by the Second in Command, information being given to the General Commandant.

The General Commandant gives direction for a meeting of the Council as often as he judge it necessary.

Art. XXVIII. Minutes of the proceedings are to be kept.

Title IV.—*Admission and Classification of the Pupils.*

Admission and Classification of the Pupils.

Art. XXIX. The pupils of the Imperial Polytechnic School who are admitted to the School of Application, and named for Sub-lieutenancies, hold the rank of Pupil Sub-lieutenant- (*sous-lieutenants élèves*). Their seniority dates from the date fixed by the decree of their nomination; and among themselves they take rank during the first year in accordance with the number of merit which they obtained at the Final Examination on quitting the Polytechnic School.

Art. XXX. When pupils are sent to the Imperial School of Application before completing the two years which the law requires at the Polytechnic School, these pupils do not receive their nomination for Sub-lieutenancies until the proper time has expired. Their designation is that of Pupils of the Artillery or Engineers, and they continue to wear the uniform of the Polytechnic School.

Art. XXXI. Our Minister the Secretary of State for the War Department sends every year to the General Commandant of the School of Application a list of the Pupil Sub-lieutenants who are to come to the School, and states the time at which they will appear there. He gives with the list the particulars relating to each one of them; he states the marks they have received, and the place they have been assigned in each of the branches.

Art. XXXII. The pupils remain two years at the School, and form two Divisions, the First (or upper) Division, one composed of pupils following the second year's courses; the Second (or lower) Division of the pupils last admitted.

The order of classification of the pupils on passing from the Second to the First Division is determined by our Minister the Secretary of State for the War Department, according to the proposals laid before him by the School and the observations made by the Inspector General.

Title V.—*Uniform, Police, and Discipline.*

Discipline.

Art. XXXIII. The Uniform of the Sub-lieutenant Cadets is fixed by a regulation of the War Department.

Art. XXXIV. The pupils are subject to Military Law and Police.

Art. XXXV. The Regulations in detail relating to the police and discipline of the School are determined by our Minister the Secretary of State for the War Department, conformably with the principles laid down in the present Decree and in the Rules of the Service.

Art XXXVI. The duty of attending, alike within the establishment and without it, to the strict and unfailing execution of all military regulations that are in force and of the special regulations that have been laid down for the School of Application, is entrusted to the Officers of the Staff of the School and to the Military Professors.

Art. XXXVII. Any pupil whose offences, without being such as to make him amenable to a military tribunal, are nevertheless sufficiently serious to call for severer punishment than is inflicted in the ordinary course of discipline, may be temporarily excluded from the School, suspended from service, and placed on the unemployed list (*mis en non-activité par suspension d'emploi*) by an Imperial decision, given on the report of our Minister the Secretary of State for the War Department.*

* Law of the 19th of May, 1834.

APPENDIX H

Discipline.

Art. XXXVIII. Any pupil who commits serious offences against discipline or honour may be finally dismissed from the School and from the Army as unfit the service (*par réforme*)* by an Imperial decision given on the report of our Minister the Secretary of State for the War Department.†

Title VI.—*Instruction.*

Instruction.

Art. XXXIX. The instruction given to the pupils includes,—

1. Instruction common to the two arms.
2. Special Instruction for the Artillery.
3. Special Instruction for the Engineers.

Art. XL. The objects of the instruction common to both arms are,—

1. The Study of the Military Regulations, the Manœuvres of Infantry, Cavalry, and Artillery.
2. The Study of Artillery.
3. Military Art and Field Fortification.
4. Permanent Fortification, Attack, and Defence of Places.
5. Topography and Dialling.
6. The Application of the Sciences of Natural Philosophy and Chemistry to the Arts of War.
7. The Application of the Science of Mechanics to Machinery.
8. Architecture and Military Construction.
9. Military Legislation and Administration.
10. German.
11. The Veterinary Art and Horsemanship.
12. Drill and Exercises (*travaux pratiques*) of the two arms, Fencing, and Swimming.

Art. XLI. The special Instruction for the Artillery pupils consists of,—

1. The Drillbook for foot and horse Artillery and service of guns.
2. Drawing of guns, gun carriages, and waggons.
3. Designs for guns.
4. Designs for machines and factories.

Art. XLII. The special Instruction for pupils in the Engineers consists of—

1. The Drillbook for Infantry.
2. Study of the application of the Principles of Fortification to actual ground.
3. Study for the improvement of an actual fortified place.
4. Geodesy.

Art. XLIII. The Programs for the out-of-door work and exercises are determined by a mixed Commission, and submitted for his approval to our Minister the Secretary of State for the War Department.

Title VII.—*Examination of the Pupil Second Lieutenants before leaving the School.*

Final Examination by a Jury nominated annually by the Minister for War

Art. XLIV. A Jury is formed every year for conducting the Examination of the pupils of the First Division of the School. It is composed of six members, viz.:—

A General of Division, as President, taken alternately from those attached to the one corps and the other.

A General of Brigade of Artillery.

A General of Brigade of Engineers.

A Field Officer of Artillery, to examine in subjects more especially concerning the Artillery service.

A Field Officer of Engineers, to examine in subjects more particularly referring to the Engineer service.

A Field Officer of one or the other arm, either on active service or on the retired list (*en retraite*) to examine in the applied sciences.

Art. XLV. The Members of the Jury are nominated every year by our Minister the Secretary of State for the War Department. The Field Officers entrusted with the functions of Examiners are taken from the lists presented yearly by the Committees of the Artillery and Engineers.‡

No Officers attached to the School can be a Member of the Jury.

Art. XLVI. The Jury assembles at the time appointed by our Minister the Secretary of State for the War Department.

Art. XLVII. The Examinations are made in succession by the three Examiners, in the presence of the Jury.

Art. XLVIII. An order from the Ministry determines the value to be attached to the various elements combining to decide the final classification of the pupils.

Jury classifies the pupils.

Art. XLIX. On the completion of the Examinations, the Jury classifies the pupils of each arm, in conformity with the order referred to in the preceding Article. This classification fixes definitively the order in which the pupils are admitted to the two services.

* See for the term, Vauchelle, vol. i. p. 375, "Les militaires et les jeunes soldats peuvent être liberés du service par inaptitude absolue; et dans ce cas ils reçoivent un *congé de réforme*."

† Law of the 19th of May, 1834, and Ordinance of the 21st of May, 1836.

‡ The Comités Consultatives.

Jury of Examiners.

Art. L Pupils of the Second Division who are mentioned by the Superior Council of the School as backward or negligent in their studies, are examined by the Jury, which decides whether they shall pass into the First Division or be reported to our Minister the Secretary of State for the War Department for classification with the pupils of the new promotion.*

Art. LI. Pupils of either Division, who, in consequence of serious illness or other properly certified interruptions, have been unable to acquire the necessary amount of instruction, may, upon the proposal of the Commandant of the School, and the Jury of Examiners, be authorized by our Minister the Secretary of State for the War Department to go again through their year of studies with the next ensuing promotion, and to compete with it.

Art. LII. No pupil can in any case remain more than three years at the School.

Art. LIII. Pupil Sub-lieutenants who appear by the decision of the Jury not to have passed the examination for leaving the School are suspended from service, and put on the unemployed list (*mis en non-activité par suspension d'emploi*), and left to the disposal of our Minister the Secretary of State for the War Department.

Jury examines the Minutes of the Councils.

Art. LIV. Over and above its proceedings that relate to the examination, the Jury after considering the minutes of the proceedings of the Councils during their sittings since the last General Inspection, enters in its report any observations which it thinks fit to make on the instruction and discipline of the School.

Reports to Minister for War.

Art. LV. The Jury records its proceedings by a minute addressed by its President to our Minister the Secretary of State for the War Department.

Title VIII. *Section* I.—*Accounts.*

Accounts.

Art. LVI. The Accounts of the School are kept in conformity with the rules prescribed for the service of the Engineers in fortified places, with the exceptions stated in the Regulations for Administration. The General Commandant performs the functions assigned to a Director of Fortifications, and the Second in Command those of a Commanding Engineer (*Chef du Génie*).†

Art. LVII. The details of administration and the various heads under which the expenses are classed in the budget are laid down by a special Regulation.

Section II.—*Pay.*

Pay.

Art. LVIII. The Officers attached to the School, the Surgeon, the pupils, the Storekeepers, and the Assistant of the Professor of Horsemanship, receive the pay of active service, and the allowances accorded to their various grades by the laws, ordinances, and decrees relative to the pay of the Army.

Art. LIX. The salaries of the civilians who hold office or are employed in the School are fixed by a scale appended to the present decree. The same scale determines the allowances for lodging and furnishing.

Art. LX. The payment of other persons employed and of the subordinate officials varies with circumstances, and is fixed as stated in Art. 12.

Art. LXI. The Librarian, the Treasurer, the Professor of German, the Drawing Master, the Principal Clerk, the skilled Mechanic, the skilled Lithographer, and the Assistant Librarian, if not already in receipt of a retiring pension, have a right to a gradual increase of their salary, namely :—

An addition of one-fifth to their original stipend after service of ten years at the School.
„ of one-third of the same after service of fifteen years.
„ and of one-half after service of twenty years

Scale of Payment and Allowances.

Office.	Salary per Annum.	Allowance for Lodging.	Allowance for Furniture.
	Fr.	Fr.	Fr.
Librarian - - - -	2,400 (96*l.*)	420 (16*l.* 16*s.*)	210 (8*l.* 8*s.*)
Treasurer - - - -	2,400	420	210
Principal Clerk - -	2,400	360 (14*l.* 8*s.*)	180 (7*l.* 4*s.*)
Professor of German - -	2,000 (80*l.*)	360	180
Drawing Master - - -	2,000	360	180
Skilled Mechanic - -	2,000	240 (9*l.* 12*s.*)	120 (4*l.* 16*s.*)
Skilled Lithographer -	2,000	240	120
Assistant Librarian - -	2,000	240	120

* The term promotion is used to express each new body of students admitted, each *admission* from the Polytechnic gradually passing through the two years at the School of Application, pupils are said to be of the same promotion, *i. e.* of the same year.

† Every fortified place and garrison (*casernement*) of any importance is considered the military capital of a district or territory (*territoire*) ; a certain number of territories form a section or command (*chefferie*), and a *direction* consists of a number of these. This last constitutes the charge of a Director of Fortifications, as the section or *chefferie* does that of a *Chef du Génie*. There are twenty-one directions in France and three in Algeria.—See the last and other particulars in Vauchelle, i. 269.

APPENDIX H.

Title IX.—*General Arrangements.*

General Arrangements. Out-of-door Work.

Art. LXII. The polygon of the Artillery, that of the Engineers, and the School of Pyrotechny serve for the manœuvres, exercises, and out-of-door work of the pupils. The Commandant of the School, after receiving the order of the General in Command of the Division, will concert measures for this purpose with the heads of the Artillery and Engineer services, and come to an understanding with them for having the necessary men and materials placed for the time at the disposal of the School.

The Commandant of the place* will give orders for having a guard, taken from the troops of the garrison, and if practicable (*de préférence*) from the corps of Artillery and of Engineers, placed at the disposal of the School.

Programmes.

Art. LXIII. The Programs of the courses of instruction for the various works to be executed by the students are printed or lithographed and distributed gratuitously to the Officers on the Staff of the School, to the Professors, and to the pupils.

Art. LXIV. Every Professor is bound to deliver to the Director of Studies, within a period of time fixed by our Minister the Secretary of State for the War Department, a synopsis of the course which is entrusted to him.

These courses cannot be printed or lithographed without the authority of our Minister the Secretary of State for the War Department.

Officers of Artillery and Engineers who have not been pupils, may be permitted to take part in the instruction.

Art. LXV. Our Minister the Secretary of State for the War Department may, upon their request, authorize the Officers of the Artillery and the Engineers who have not passed through the School of Application to take part in the instruction given at it. A special Regulation will determine the conditions under which the authority will be given.†

Art. LXVI. The regulations made by Articles 8 and 11 of the present Decree notwithstanding, our Minister the Secretary of State for the War Department is authorized to retain in the employment they at present hold, all the functionaries whose cases do not come within the terms of the new organization with the exception, however, of those who have reached or passed the limit of age fixed by Art. 13.

Art. LXVII. All Regulations contrary to the present Decree are and do remain abrogated.

Art. LXVIII. Our Minister the Secretary of State for the War Department is charged with the execution of the present Decree.

Done at the Palace of Saint Cloud, 24th June, 1854. (Signed) Napoleon.

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* Metz being a fortified place with a garrison and a Commandant.

† Artillery and Engineer Officers on promotion from the ranks are thus admissible, and are constantly admitted. See above in the report to the Emperor, p 77.

APPENDIX I.

ABRIDGEMENT OF THE REGULATIONS ENFORCED AND OF THE PARTICULAR PROGRAMMES OF THE COURSES OF INSTRUCTION GIVEN AT THE IMPERIAL SCHOOL OF APPLICATION FOR THE ARTILLERY AND ENGINEERS.

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1.—POLICE REGULATIONS.

Discipline.

The chief Regulations for the Police of the Establishment are as follows :—

I. Barracks.—The Students are lodged in Barracks in the School, under the command of a Captain of the Staff, with the title of Commandant of the Quarter. They take their meals, however, out of the Barracks, in the town. They are allowed free egress and ingress from and to their Barracks, from the call at 6 in the morning to 10 at night, excepting during the hours devoted to lectures and the studies in the rooms. During these hours they must give special notice of their times of going out and coming in.

II. Organization into Brigades and Sections.—Each Division is arranged in Brigades of thirty Students at the utmost, and each Brigade in two sections. The Students of Artillery and those of the Engineers constitute, as far as possible, separate Brigades. A Captain of the Staff is attached to each Brigade for its superintendence. The students in these Brigades and Sections are arranged in the order of merit which they held on entrance, and the first Student on the list of each Brigade and of each section of a Brigade is called its Chief. This arrangement is preserved at their messes, which are held at the Restaurateurs', each section of fifteen having its own table, and its chief being the head of the mess. Private bills or private additions to the mess are forbidden, the maximum price for the daily fare being fixed by the Commandant of the School.

III. Conduct of the Students.—All games of chance are forbidden; and any debts discovered are punished. If a Student continues long without paying such, he is reported to the Minister of War.

IV. Inspection of Work done within the House.—No work or drawing may be done out of the rooms of study, except in cases of illness.

All works to be executed by the Students are considered as service ordered to be done, which must be completed at the hours and within the period fixed in the order of the day. Students who are in arrears of work at the end of their first year are required to finish them during the time of vacation.

V. Superintendence of out-of-door Work.—After describing facilities afforded to the Students for working in the country, and stating minutely the method to be followed, the directions add that "on bringing back their plans, Students must present their "sketches, and all the notes taken by them, in their rough state, to the Officer of the "Staff entrusted to inspect them. They cannot begin to put their work into shape till "this Officer's visa has been affixed to the sketches, notes," &c.

VI. Vacation.—There is one vacation at the end of the first year. Any class, or any single student, under punishment, may be deprived of this. Any work to which the Professor gives a mark below 7, must be considered incomplete, and to be done again. Students are kept up in vacation to finish their work; but if it is done within fifteen days, and marked by the Professor's visa, they are allowed to go away for the rest of the vacation.

Young Officers, after their final examination, are subject to all the Regulations of the School, down to the moment of their leaving the town.

APPENDIX I.—2.

Estimation of value of work done.

2.—REGULATIONS FOR ESTIMATING THE VALUE OF THE WORK EXECUTED.

The time devoted to each of the courses in the School, to the works of every kind which belong to it, to the exercises, drill, theoretical instructions, &c., is fixed in accordance with programs approved by the Minister of War; and the Table similar to that given at pages 105-106, exhibiting the employment, is each year submitted for his approbation by the Superior Council of the School.

Every kind of work, such as the out-door operations, sketches, drawings, memoirs, calculations, interrogations, manipulations, manœuvres, drill, &c., is valued by the Professor or Officer of the Staff charged with its direction, by the product of two numbers, one representing the merit of its execution, and the other the importance of the work.

The numbers representing the merit of the execution or instruction are regulated by the scale of 0 to 20, as at the Polytechnic School.

The coefficient of importance is found by dividing the number representing the maximum value allowed for the execution of any work by 20, the maximum credit for merit; and the number representing the maximum value, allowed for the execution of any work has reference to all the circumstances bearing upon its execution. It is regulated by the number of hours appropriated to its execution; and in estimating this number of hours, regard is had, not only to the time occupied in making the drawing, but also to that which is necessary for the calculations, essays, and sketches indispensable to its execution. The lectures are reckoned at one and a half hours, and the sittings in the Halls of Study at four and a half hours.

The number of hours inserted in the Table giving the distribution of the time employed, being insufficient for the composition of the memoirs, specifications, estimates, &c., the value given for this kind of work, of which a great part is performed out of the Halls of Study, is fixed at twice the number of hours inserted in the Table showing the distribution of the time employed.

The interrogations are the subject of a special credit, the maximum being equal to the number of hours devoted to the lectures, multiplied by one and a half hour, the length of each lecture.

The credit given for a work performed outside the school is divided into two parts: one, equal to one-third of the total credit, is in the hands of the Officer charged with the superintendence of the work, who estimates the zeal and aptitude of the student; the other, equal to two-thirds, is applied by the Professor, and given according to the merit of the work.

The sum of the credits, given for work of all kinds in a course of study, forms the maximum credit for the course.

The method of fixing the credit for the execution of works, according to the time devoted to them, is equally applicable to the exercises, practice, and drill.

When the time granted for the execution of any work has expired, the Director of Studies sends this work to the Professor for his examination, who establishes the number or credit, showing its importance, and returns it to the Director of Studies.

Every work which has been finished and examined, is marked by the Professor by a number representing its merit, which number may be fractional.

This is multiplied by the number representing its importance, and the nearest whole number resulting from this product expresses the value of the examined work.

Every unfinished work receives a provisional value, and is then returned to the person executing it, and as soon as it has been completed a second evaluation is made, but only two-thirds of the difference between the first and second evaluations is added to the first; the same principle is applied to the works which have been valued below seven, or to those which have been amended or re-commenced.

Every work which has not been executed by the student is marked 0; but the grounds for its non-execution are placed before the Jury of Examination.

In the event of two papers being so similar that it is evident one must have been copied from the other, and that it is not possible to decide which has been copied from the other, both are marked 0.

And on the other hand, if it is proved that there was no complicity between the authors of the two papers, the copied paper is the only one cancelled.

At the end of each year's study, the Council of the School makes a classification of the students of the two divisions.

Each of these classifications is formed of the following elements:—

1st. Notes of conduct given by the General commanding and the Colonel Second in Command.

2nd. Notes of appreciation given by the General Commanding, and the Colonel Second in Command, and by the Officers of the Staff of the School.

3rd. Tables of credits given by two Field Officers of the Artillery and Engineers on the theoretical and practical instruction with which they are charged.

4th. Tables of credits given by each Professor for the works of all kinds, interrogations, &c., of his course.

The classification of the first year comprehends all the works, drill, and practice, executed during the first year, which have been valued, as well as the notes of appreciation and of conduct.

The number appropriated to these notes at the end of the first year is equal to the moiety of the total number allowed for the two years of study.

Estimation of value of work done.

The classification of the students of the second year presents the reunion of the works executed by them since their entrance into the school.

The maximum number of credits appropriated to all the Officers of the Staff, as a note of appreciation, is equal to one-sixth of the total of all the courses taken together.

The same number, divided into two equal parts, is assigned to the notes of appreciation given by the General commanding and the Second in Command.

Lastly, the notes of conduct given by the General commanding and the Second in Command form one-fiftieth of the total value.

For the classification of each division the Director of Studies abstracts into a Table, for each arm, all the elements which should enter into this classification. Below the name of each student are inserted all the credits which belong to him, and the total, reduced in the ratio of the maximum 20, is the definitive number of the classification of each student.

The Director of Studies appends to these Tables a report containing everything which affords a means of estimating the work, the conduct of each student, the delays, and the causes, &c. In giving the names of the students whose credits is less than 7, he proposes, conformably with the Regulations, the measures that should be taken with regard to them.

The Superior Council of the School being assembled, the different Tables furnished by the Professors and by the Officers of the Staff, as well as those in which they are summed up, are collated, and the list of classifications for each division and for each arm is fixed separately, with the definitive numbers representing the credits.

These classified lists indicate for each arm the new rank of the Students, their rank at admission to the School of Application and of passage to the first division, the sum of the values for the works executed by them, and all the elements which would tend to enable a proper judgment to be formed of their merits and conduct.

The Superior Council adds to it, if there be any necessity for it, notes, exposing the grounds which have contributed to the principal alterations in the relative position of the Student, and points out those whose credit is less than 7, as well as those who by their bad conduct deserve to become the object of exceptional measures.

Examination for Leaving.

Final Examination.

Each year the General commanding the School determines by lot, at least one month in advance, the order in which the examinations for the promotions in the Artillery and Engineers are to take place. The Students belonging to the same arm can change among themselves, but eight days after the lots have been drawn the list of the order of examination is definitely closed. The General commanding the School makes known at the same period the order of the examinations and the division of the subjects between these examinations.

The General commanding the School places before the General of Division, President of the Jury of Examination, the following :—

1st. The division of the subjects between the three examinations.

2nd. The order of examination of the Arms, and of the students of each Arm.

3rd. The provisional classification of the students of the first division made by the Superior Council.

4th. The particular reports relating to each student made by the General commanding the School.

5th. The list of the propositions made by the Superior Council and the proceedings of the sitting at which it was agreed to.

6th. The classification of the Students of the second Division.

7th. Tables of questions established for each course.

8th. The abstracts of the sittings of the Superior Council held since the last examination.

The Student Sub-lieutenants are successively examined in all the branches composing the theoretical and practical instruction of the School. The theoretical knowledge is grouped in three series, each of which is the object of a particular trial.

The drill and practice are executed in the presence of the Jury, who cause the command to be given to the Sub-lieutenant, in order to satisfy themselves of the amount of their instruction, and to assign marks of merit to them individually.

The subjects of the three examinations are divided in the following manner :—

First. Examination, made by the Field Officer of Artillery in the—
- Course of Military Art.
- Course of Artillery.
- Course of Veterinary Art.
- Sham Siege (part relating to Artillery).
- Course of Military Law and Administration.

Second. Examination, held by the Field Officer of Engineers.
- Course of Permanent Fortification and the Attack and Defence of Places.
- Course of Construction.
- Sham Siege (part relating to the Engineering.)

APPENDIX I—2.

Final Examination.

Third. Examination, held by the third Examiner, taken either from the Artillery or Engineers, in the—

Course of Mechanics.
Course of Applied Sciences.
Course of Topography and Geodesy.
German Language.

Every Student, on presenting himself before the Examiners, submits for their approbation the drawings and manuscripts relating to the subjects on which the examination is to bear. Independent of the questions which are placed before him by the Examiners, the Student Sub-lieutenant must reply to any objections or questions which the members of the Jury may think fit to address to him.

The German Master directly questions the Students, if the Jury wish it. The Professors or their Assistants must be present at the examinations relating to their course.

As soon as the examination is ended, the members of the Jury retire to an adjoining room with closed doors, to determine on the amount of marks to be given to the Student examined.

When the trials of all kinds are finished, the Jury proceeds to the definitive classification of the Students belonging to each arm. In making this classification, regard is had to the following considerations :—

1st. Each examination has a coefficient of importance equal to the sum of all the different courses which are included in it.

2nd. The coefficient of importance for drawing is equal to the $\frac{1}{2}\frac{1}{0}$ of the sum of the coefficients of the three examinations.

3rd. The coefficient of importance of the practice, drill, &c., is, as for the courses, the sum of the coefficients appropriated to the works taught in the School.

By multiplying the coefficients of importance by the mean number of marks of merit obtained by the Students in the different examinations, the definitive credit which must be assigned to each Student in the Table of Classification is obtained.

The classification of the School enters into the definitive classification for a value equal to one-third of the total number of the three examinations, without comprising the valuation of the drawings ; this value is added to the credits determined above.

The Jury gives an account of the proceedings of the examinations in a *"procès-verbal"* addressed to the Minister by the General acting as President.

3.—PROGRAMME OF THE ARTILLERY COURSE.

First Part.—Introduction.

Twenty-six Lectures common to Students of both Arms.

First Lecture.

Artillery.

1. Definition of the word Artillery. Material, personnel, science. Object and division of the course.

First Section.—Effects of Powder.

Ideas on the origin of powder and its use in fire-arms ; mealed or pulverised powder ; powder in grain. General conditions which powder ought to satisfy ; action of each of its component parts. Proportion of component parts used in France. *Fulmi-ligneux.*

Gunpowder.

Considerations on the physical properties of powder. Size of the grains expressed by the number of grains to the gramme. Density of the grains and specific density of the powder ; circumstances causing them to vary. Effects of damp upon powder.

Second Lecture.

2. Combustion of powder. Different modes of ignition of powder. Research respecting the laws of its combustion, process of observation employed, laws discovered. Influence of the density, the composition, the mode of manufacture, the damp, the tension and temperature of the surrounding gases.

Combustion of the grains of powder. Calculation applied to the spherical grain. The formula is applicable to the irregular grains of ordinary powder.

Calculation of the density of the gases of powder in a fixed space, on the hypothesis of a simultaneous ignition of the grains. Discussion of the formula obtained ; influence of the density of the grains, of the duration of their combustion and of the space in which the powder is enclosed.

Inquiry into the rapidity of ignition of charges of powder. Experiments made upon trains of powder, and upon gunbarrels filled with powder. Conclusions drawn from the results obtained.

Third Lecture.

Artillery.

3. Calculation of the density of the gases of the powder on the hypothesis of successive ignition.

Gunpowder.

Results of the application of the formula to charges of a spherical and a truncated form.

Tension of the gases of powder. Impossibility of determining it by considerations of a purely theoretical nature. Experimental solution of this question. Experiments by Rumfort; description of his apparatus. Results obtained. Formula representing them. Observations on these results.

Fourth Lecture.

4. Effects of powder in a fixed space.

Hollow projectiles. The readiest bursting of a hollow sphere takes place in the direction of the plane of a great circle. Determination of the minimum bursting charge; law by which this charge varies with the thickness of the envelope. Influence of the fuse hole of hollow projectiles; weakening of the envelope of the shell, diminution of the charge; loss of gas, increase of the charge. Effects of the shock of the exploding gases; means of estimating it. Influence of the vivacity of the powder in burning. Number and rapidity of the explosions.

Hollow cylinders burst more easily longitudinally than transversely. Consequences of this principle relatively to the employment of a fibrous metal for the manufacture of arms. Thickness necessary to resist bursting.

Fifth Lecture.

5. Effects of powder in cannon.

Analytical theory of the effects of powder in cannon.

Equation of the problem. General expressions of the quantity of force exercised by the expansion of the gases,—of the density of the different sections of gas and of their tension. Differential equations of the motion of the gases, of the projectile, and of the gun. Equation of condition leading to the establishment of the general formula which determines the position of a stratum of gas in the terms of the function of its original position, and of the other data of the question. General relations between the velocity of the projectile and that of the gun.

Density of the stratum of gas at a given moment. Position of the stratum which has a maximum density.

Sixth Lecture.

6. Approximative solution applicable to the cases ordinarily met with in practice. Hypothesis relating to the velocity and the tension of different strata of gas.

Relations between the velocity of the projectile and that of the gun. Approximate expression of the amount of force due to the expansion of the gases; line to be followed in the execution of the arithmetical calculations. Formula serving to determine the velocity of the projectile. General considerations on the state of the gases of powder during the burning of the charge. Influence of the motions of the projectile and of the bottom of the bore on the distribution of the gases at each instant. Influence of the successive generation of the gases combined with the enlargement of the space which encloses them on their density throughout the whole duration of the phenomenon.

Seventh Lecture.

7. Influence of the vent and of the windage of the projectile on the effects of powder in cannon.

Determination of the loss of velocity occasioned by the windage of the projectile. Influence of the weight of the piece upon the velocity of the projectile. Influence of the weight of the projectile on the tension of the gases and upon the velocities of the two bodies set in motion. Influence of the weight of the charge of powder. Charge giving the maximum of velocity. Influence of the size and density of the grains of the powder as well as other circumstances which cause a variation in the law of generation of the gases. Advantage of very rapid combustion in short pieces and of slower combustion in long ones.

Eighth Lecture.

8. Influence of the length of bore; circumstances which modify it; length corresponding to the maximum of velocity. Comparison of the quantities of motion of the projectile and of the gun. Trial of a formula fitted to represent their relation. Determination of this relation with the help of the balistic pendulum.

Mean pressure exercised on the projectile during its passage through the bore. Injuries produced in guns by firing; enlargement of metal and cracks; lodgment and percussion of the projectile.

Different effects of the percussion; means tried to prevent injuries (in general). Considerations on the metals employed in the manufacture of ordnance. Charging with elongated cartridge; use of wooden bottoms and wads.

Ninth Lecture.

9. Examination of the proper means for measuring the effects of powder. Eprouvettes of different sorts. Experimental processes founded on the measure of the velocity of the

APPENDIX I.—3. Artillery.

projectile. Grobert's rotatory machine. Process of Colonel Debooz. Process based on the employment of an electric current. Method by ranges (mentioned here by way of note).

Balistic pendulum. Pendulum of Robins, of d'Arcy, of Hutton. Improvements introduced in France into the construction of these apparatus. Description of the pendulums in use at the present day; cannon pendulum; musket pendulum.

Tenth Lecture.

Balistic pendulum.

10. Analytical theory of the balistic pendulum.

1. Receiver pendulum; formula which gives the velocity of the projectile. Determination of the elements which enter into the formula, and the degree of approximation necessary. Simplification of the calculation of the velocities in the case of firing several times consecutively.
2. Cannon pendulum. Amount of recoil in the gun. Percussion of the knife-edges of the pendulum. Case where there is none. Means of correcting the position of the centre of percussion.

Eleventh Lecture.

Recoil.

11. Examination of the effects of the recoil upon guns and their carriages. The question may be considered as resolving itself into two others.

1. Percussions of the carriage upon the points supporting it; analytical solution. Determination of the percussions and of the force of the recoil in the case of carriages on wheels, and that of mortar beds. Graphic solution of the same question by an analysis of the force which acts upon the bottom of the bore. Modification of the sketch according to the different cases presented by the direction of fire relatively to the ground.

Twelfth Lecture.

12. Discussion of points relating to the percussion of the carriage upon its supports, and to the force of the recoil. Influence of the elevation of the line of fire; of the inclination of the ground or of the platform; of the length of the carriage in proportion to its height and of the friction which results from the contact of the trail with the ground. Velocity of recoil of the collective apparatus. Determination of the extent of the recoil on a given ground. Recoil of the different pieces of ordnance in use. Case in which the forepart of the carriage has a tendency to be lifted up; velocity of this motion; determination of the effect resulting from it.

Thirteenth Lecture.

13. 2. Percussions produced by the gun upon its carriage. Determination of the amount of percussion of the breech upon the elevating screw, and of that of the trunnions upon the trunnion holes. Discussion of points relative to the effects produced. Influence of the elevation; of the dimensions of the gun, and of the proportion of its weight to that of the entire apparatus.

Effect of the elasticity of the different parts of the apparatus. It diminishes the wear of the parts struck, and renders it necessary to take into account the velocity of the parts striking.

Fourteenth Lecture.

Mines.

14. Effects of powder in mines. Historical notices. Dimensions of the boxes containing the powder. Considerations on the effects of the expansion of the gases in an indefinite or limited compressible medium.

Definitions having reference to craters and chambers of mines. Ordinary charge of the chamber. The old rule for miners; its entire alteration. Table relating to different kinds of medium. Overcharged chamber. Undercharged chamber or "camouflet." Limit of the effects of compression which result from the action of the chambers. Use of gun cotton. Considerations on the effects of the petard. Dimensions of the cavity reserved for the powder. Means employed or proposed to diminish the charge of powder proportioned to a given effect.

SECOND SECTION.—MOTION OF PROJECTILES IN SPACE.

Fifteenth Lecture.

Science of Projectiles.

15. Science of projectiles. Historical notices. Utility of an acquaintance with the laws of the motion of projectiles in a vacuum. Definitions relating to the trajectory Differential equations of the motion in vacuo. Equation of the trajectory. Inclination of its elements. Velocity of the projectile at any one point. Duration of its passage. Determination of the range and of the angle of greatest range. Relations between the ranges; the initial velocities; and the angles of projection. Examination of the cases where the theory of the parabola is applicable.

Preliminary ideas on the resistance of fluids; difficulties inherent in this question. Approximative formula of the resistance, established by the help of the principle of active forces; circumstances not taken into consideration by it.

Sixteenth Lecture.

16. Experiments relating to the determination of the resistance of the air.

1. Case of small velocities. Rotatory apparatus; results furnished by them in the case of thin planes; their essential defect. Apparatus with rectilinear movement. Mean value of the co-efficient of the theoretical resistance in the case of thin planes; modification of this value for the case of spheres, &c.

2. Case of great velocities. Direct determination of the resistance of the air by the aid of the balistic pendulum. Experiments of Hutton, their results. Experiments made at Metz in 1839 and 1840. General expression of the resistance based upon the total of the results obtained, and containing a function of the velocity in three terms. Search after a function in two terms fit to replace in each particular case the general expression.

Seventeenth Lecture.

17. Theory of the motion of projectiles in the air. Differential equations of the motion. Hypothesis on the relation of the element of the trajectory to its projection Calculations based on this hypothesis, and leading to the final equation of the arc of th trajectory. Inclination of the element of the trajectory. Velocity of the projectile at a given point. Duration of the passage.

Eighteenth Lecture.

18. Examination of the functions employed in the formulas of the science of projectiles. Formation of the balistic coefficient, and the series contained in the functions. Relations of the series and the functions to each other. Arithmetical tables designed to give their values. Determination of the relation of an arc of the trajectory to its projection. Error resulting from the introduction of the constant relation in balistic calculations.

Nineteenth Lecture.

Science of Projectiles.

19. Application of balistic theories to the movement of projectiles thrown at great angles. Analysis of the trajectory, and determination of all the circumstances of the movement. Trajectory of shells considered as a single arc. Solution of several problems involved in this hypothesis. Determination of the range. Velocity corresponding to a given range and angle of projection. Angle of projection corresponding to a known initial velocity and range. Angle of greatest range. Variation of the velocity of the projectile during the whole of its passage. Limit of velocity of projectiles falling vertically in the air.

Twentieth Lecture.

20. Application of balistic theories to the motion of projectiles thrown at low angles. Case where the relation of the arc to its projection can be supposed sensibly equal to unity. Problems relative to direct fire; distinction established between the angle of projection and the angle of fire. In ordinary cases in practice the angle of fire is very nearly independent of the height of the object aimed at. Relations between the angle of projection, the angle of elevation of the object aimed at, and the angle of descent. Problems relating to plunging fire. (Ricochet fire.) Determination of the initial velocity and the angle of projection for a projectile which has to pass, firstly, through two given points; secondly, through one given point, the trajectory having at this point a known direction. Case of practical impossibility.

Twenty-first Lecture.

21. Relations between the velocities, the spaces traversed, and the durations of passage in the rectilinear movement of projectiles. They are applicable to direct fire, and are independent of the function of the velocity which enters into the expression of the resistance of the air. Case where the resistance of the air can be supposed proportional to the square of the velocity. Establishment of balistic formulas in this hypothesis. Application of the formulas to the resolution of one of the problems connected with a plunging fire. Comparison of the results obtained with those arrived at by the use of general formulas. Indication of methods applicable to the resolution of several questions in projectiles.

Twenty-second Lecture.

22. Examination of disturbing causes which influence the motion of projectiles. 1. Disturbing causes acting on the projectile during its passage through the bore. Imperfections of form, such as want of straightness in the bore, faulty position of the line of sight and the trunnions.

Influence of the windage of the projectile and of the percussions which result from it. Deviation from the original direction; its consequence in the different kinds of fire. Effect of the recoil and the vibrations of the barrel in the fire of small arms.

Influence of the various causes which are capable of modifying the initial velocity. 2. Disturbing causes acting upon the projectile during its passage through the air. Influence of the rotatory motion which results from the last percussion within the bore.

APPENDIX I.—3. Artillery.

Effects of the eccentricity of projectiles. Case where the rotation occasions no deviation. Influence of the proximity of the ground. Deviation produced by the wind (air in motion). Influence of atmospheric changes.

Third Section.—Motion of Carriages.

Twenty-third Lecture.

Motion of Carriages.

23. Importance of the question. Preliminary ideas. Resistance due to the motion of a carriage and determination of the effort necessary for drawing it in the case of uniform motion. Two-wheeled carriage on level ground; the effort of draught in a direction parallel to the ground; first, resistance referable to the friction of the wheels on the axle; secondly, resistance referable to their revolution upon the ground. Influence of the weight of the carriage. Advantage of large wheels over small ones, demonstrated in the two cases of a yielding soil and a hard soil scattered over with obstacles. Expression of the power of draught necessary to overcome the two resistances united.

Twenty-fourth Lecture.

24. General expressions of the effort of draught necessary for two-wheeled and four-wheeled carriages; case of a locked wheel. Influence of the direction of the traces and of the inclination of the ground upon the draught. Advantage of rolling over dragging for the transport of burdens. Examination of resistances which are developed in the passage from repose to motion. Considerations on the position of the fillet in the box, and determination of the coefficient of friction for the case of the revolution of the wheel about the axle.

Influence of the length of the nave on the frictions when the axle is thrown out of a horizontal position.

Twenty-fifth Lecture.

Draught.

25. Turning of carriages considered successively in the case of two-wheeled ond four-wheeled carriages. Centre and angle of the turn in four wheeled carriages. Calculations of the angle of the turn and of the space required by the carriage to execute a half turn. Examination of the dimensions of the carriage which influence the angle of the turn. Diameter of the fore-wheels and height of the body of the carriage; distance between the wheels and breadth of the body of the carriage; position of the point of reunion of its fore and hind parts. Examination of the circumstances favourable or unfavourable to the action of the horse. Relation between the forces to which he is subjected, and the pressure of his feet on the ground. Sliding of the feet; influence of the weight of the animal; of the coefficient of friction; and of the direction of the traces. Lifting of the forehand; influence of the weight of the horse, and of the increased distance between the points on which he rests; of the position of his centre of gravity; and of the direction of the traces.

Twenty-sixth Lecture.

26. Considerations on the mode of action of the draught-horse. Effect of his weight, and of the inclination of the traces. Effort of draught of which the horse is capable, both momentarily and continuously; results of experiments. Composition of artillery harness. Harness à limonière (with shafts and cross-bar), or on the French system; on the German system, with pole and support. Use and discontinuance of swing bars. Arrangement of the traces. General arrangement of harness. Bât-saddle.

SECOND PART.

Classified Account of Small Arms and of Artillery Material.

Twenty Lectures, of which Fourteen are common to the Students of both Arms and Six confined to Artillery Students.

First Section.—Small Arms.

Twenty-seventh Lecture.

Small arms.

1. Classification of small arms. Arms not fire-arms. Classification of hand-weapons. Considerations on the profile and outline of cutting weapons. Effect of the curve. Division of the mass. Form of the hilt.

Considerations on the profile and outline of thrusting weapons.

Position of the centre of gravity; form of the point. Description of arms other than fire-arms now in use. Sabres and swords. General ideas respecting their component parts; blade, hilt, and scabbard. Regimental arms. Infantry sword. Sword-bayonet of

Artillery.

the artillery and chasseurs, cavalry sword; peculiar requisites. Sword of cavalry of reserve, of cavalry of the line, and of light cavalry. Horse artillery sword.

Officers' and non-commissioned officers' arms. Cavalry lance. Camping axe. Side-arms in use in the navy. Sword, pike, boarding-axe, dirk.

Defensive armour. Cuirassiers and carabineers' cuirasses. Cuirass and helmet of the sapper.

Twenty-eighth Lecture.

2. Fire-arms. Historical notices. First attempts in fire-arms. Hand cannons. Arquebuses, culverines, &c. Poitrinal, matchlock, firelock, pistol, and blunderbuss.

Means employed successively for loading and ignition of the charge. Twisted match, wheel-lock, flint-lock, percussion-lock (the two last mentioned here by way of note). Classified account of fire-arms now in use. Muskets. Considerations on the weight and principal dimensions of muskets. Detailed description of the infantry musket. Action of the flint and the percussion lock.

Twenty-ninth Lecture.

Rifled arms.

3. Comparison of the flint and the percussion musket. Voltigeur's, dragoon's, and double-barrelled musket. Gendarmerie and cavalry carbine. Cavalry and gendarmerie pistol. Arms in which precision of aim is studied. Means employed to prevent the deviations caused by the windage of the projectiles and their rotatory movement in the air. Diminution and suppression of the windage; straight grooves in the barrel, spiral grooves, rifled arms. Rotation of the ball about its axis of flight.

Principles of arrangement of rifled arms. Charge of powder and inclination of the grooves; two modes of solution, powerful charge and long spiral, weak charge and short spiral. Length of the barrel; conditions which determine it; number and form of the grooves.

Thirtieth Lecture.

4. Loading of rifled arms; ramming the ball home; loading at the breech. Different methods tried. Loading with a flattened ball; effect of the flattening of the ball. Examination of the successive improvements to which this idea has served as a basis. Chambered arms; use of the short bottom and the patch. Arms *à tige*. Elongation of the ball; shortening of the spiral groove; diminution of the charge; advantages resulting from it. Pointed cylindrical ball; principles of its outline; effect of the notches of the ball; superiority of this projectile over the spherical balls. Summary examination of the different models of rifled arms which have been successively in use. Versailles rifles.

Wall-piece, pattern 1831. Common rifle, pattern 1842. Wall-piece, pattern 1840. Bored-up wall-piece, pattern 1842. Pistols for officers of cavalry and gendarmerie. Rifles *à tige*, pattern 1846, and artillery carbine *à tige*. Description of these two arms. Superiority of the rifle *à tige* over the arms for precise aim previously adopted. Trial relating to a new improvement in the construction of rifled arms. Disuse of the "*tige*." Ball with cup. Comparative notice of the fire-arms of the different European powers.

Second Section.—Projectiles and Cannon.

Thirty-first Lecture.

Projectiles.

5. Principles of construction of projectiles.

Considerations on the substances which may be chosen for the manufacture of projectiles. Essential conditions, density, hardness, tenacity, cheapness. Projectiles of stone, lead, cast-iron, iron, copper, gun-metal. Forms of projectiles.

Exterior form; conditions which serve to determine it. The spherical form preferable to any other in the actual state of artillery. Advantage of elongated projectiles. Conditions relating to their use. First attempts. Interior form of hollow projectiles; howitzer-shells, bombs, and grenades. Thickness of the metal; fuse-hole; charging hole of naval hollow projectiles; lugs or handles of shells. Density of projectiles. Recapitulation of the balls; howitzer shells; shells and grenades in use, their nomenclature, dimensions, weight. Cannon balls. Choice of metal and weights. Different arrangements for the use of shot, case-shot, canister or naval grape-shot. Spherical case; conditions relating to their use. Charge of spherical case. Bar-shot. Rescue shells.

Thirty-second Lecture.

Cannon.

6. Cannon. Historical ideas on the subject. Principles of arrangement of ancient arms and machines of war. Motive force employed; its inferiority compared to that furnished by the combustion of powder. Earliest cannon.

Historical view of the different systems of ordnance which have been successively in use in France.

1. Cannon. Calibres in use in the 16th century. Edict of Blois, 1572. Cannon employed in the reign of Louis XIV. Regulation of 1732. System of Vallière. Modifications introduced by Gribeauval in 1765. Cannon of the year XI. Cannon in use at the present day.

APPENDIX I.—3.

Artillery.

2. Ordnance adapted to hollow projectiles. Difficulties inseparable from the throwing of hollow projectiles; first attempts. Mortars. Double fire. Ancient calibres. Mortars in use at the present day. Stone mortar. Howitzers, their first use in the French artillery; howitzers of 1765; of the year XI. Calibres in use at the present day. Considerations on the calibres of different kinds of cannon. Siege, garrison, field, coast, and naval ordnance. Siege, garrison, field, mountain, coast, and naval howitzers. Mortars and stone mortars. Considerations on the metals which may be employed in the manufacture of cannon for siege, garrison, field, coast, and naval purposes. Interior form of ordnance.

1. Part of the bore traversed by the projectile, transverse section; trial of rifled cannon, longitudinal section.
2. Part of the bore occupied by the charge; influence of its form; the spherical, cylindrical, truncated form. Chambers of mortars; reason for their adoption. Cylindrical and truncated chambers; comparison of their effects. Spherical chamber; pyriform chamber; interior form of the naval mortar *à semelle* (cast in one piece with the bed). Chamber of howitzers; experiments with reference to their adoption for field howitzers. Dimension. Howitzers without chamber. Chamber of carronades. Junction of the chambers with the rest of the bore: form of the bottom of the bore or of the chamber.

Thirty-third Lecture.

7. Vent; its object, its dimensions. Bushes inserted before casting (*masses de lumière*); after casting (*grains de lumière*). Considerations on the position of the vent relatively to the charge. Experiments made with the infantry musket, and with 24 and 16 pounder guns.

Arrangement of the vent in guns of 1732; portfire chamber. Vent of mortars. Priming pans. Windage of projectiles; conditions which determine it for the different services. Rules received with respect to ancient guns. Dimensions in use at the present day. Different characteristics resulting from the windage of projectiles. Length of the bore. Question of the length of the bore considered with reference to the projectile effect of the powder. The length of ordnance is determined by considerations unconnected with this effect.

Cannon.

Length of bore of siege and defensive artillery, of field, coast, and naval guns. Length of bore of mortars, and of the stone mortar. Length of bore of howitzers. Thickness of metal and external outline. Cannon:—Theoretical determination of the external outline necessary for resistance to the effect of the gases of the powder. Coefficient of resistance, its value in the guns in use. Thickness in the chase necessary for resistance to the percussions of the projectile.

Swell or moulding of the muzzle. Thickness at the position occupied by the trunnions. Thickness of metal of the different systems of cannon which have been successively in use in France. Thickness of metal in howitzers. Form resulting from the diminution of internal diameter, at the position occupied by the chamber. Exceptional form of the siege howitzer. Outline of the interior of mortars.

Thirty-fourth Lecture.

8. Line of sight; its object and arrangement. Considerations on the inclination of the line of sight relatively to the axis of the gun. Trunnions; object and arrangement of trunnions and their shoulders. Position of trunnions relatively to the centre of gravity of the gun. Preponderance of the breech over the chase; manner of estimating it; preponderance allowed in the different guns in use. General principle serving as the basis for its adoption. Position of trunnions relatively to the axis of guns. Reasons for their depression; circumstances which cause it to vary. Trunnions of mortars; their reinforces. Dolphins of ordnance. Weight of ordnance; necessary relation between the weight of a gun, and the quantity of movement of its projectile. Conditions serving to determine the weight of the different species of cannon, howitzers, and mortars in use. Examination of the weights adopted for the pieces of ordnance of all sorts, which have been successively employed. General recapitulation of the different species of ordnance in use. Nomenclature. Dimensions, weight. Land artillery. Siege, garrison, and field guns. Siege, garrison, field, and mountain howitzers, mortars, and stone mortars. Naval artillery. Cannon, carronades, howitzers, mortars, stone mortar, blunderbuss. Observations on ordnance. Exceptional ordnance. Villantroys howitzers. Belgian mortar of 60 c., &c. Description of the artillery petard.

THIRD SECTION.—WAR AND SIGNAL ROCKETS.

Thirty-fifth Lecture.

Rockets.

9. Historical ideas on the subject. Cause of the motion of rockets. Their exterior and interior form. Relation which should exist between the law of generation of the gases and the orifice for their escape. Measure of the tension of the gases in rockets. Results of experiments. Motion of the rocket. Variation of the velocity during its passage. Means of regulating the motion; effect of the directing stick. Influence of the wind upon the trajectory of the rocket.

Description of rockets in use.—1st. War rockets; calibres employed; body of the rocket; arrangement of the stick. Projectiles fitted to the head of the rocket; rockets without stick. 2d. Signal rockets; their calibres and composition.

Fourth Section.—Carriages.

Thirty-sixth Lecture.

10. Historical ideas on the subject. Arrangements originally in use for the service of ordnance. Successive improvements. Carriages on wheels. Introduction of limbers. General conditions which gun-carriages should satisfy.

General principles of their construction:—1st. With reference to the act of firing. 2dly. With a view to transport.

Mortar carriages. Particular requisites. Description of the carriages in use. Siege carriages; particular conditions. General arrangement of ancient siege carriages. Detailed description of the present siege carriage and its limber; its weight and different characteristics. Field carriage; particular requisites; general arrangement of the carriages employed before 1765. Field carriages of the system of Gribeauval; its defects. General arrangement and detailed description of the present field carriage and of its limber. Weight and different characteristics. Mountain carriages; particular requisites; description of the carriage and of the arrangement of its shafts (*limonière.*). Carriages.

Thirty-seventh Lecture.

11. Garrison and coast carriages; particular requisites; object of the platform for the two systems; its principal dimensions; position of the pintle or working bolt (*cheville ouvrière*). General arrangement of ancient garrison and coast gun carriages. Description of the present garrison carriage; change of the carriage into a moveable one on four wheels; weight and different characteristics. Replacement of the platform by a directing transom bed under certain circumstances of the service. Casemate carriage. Iron carriages; inconveniences of this kind of construction for siege purposes and on the field of battle; its advantages for the armament of coasts. Description of the coast carriage actually in use; weight and different characteristics. Naval carriages; particular requisites. General arrangement of naval carriages in use. Carriage on four small wheels for cannon. Bracket carriage (*à échantignolle*), and carriage with double pivot platform for howitzers. Carronade carriage. Mortar bed, cast in one piece with the mortar, (*à plaque*). Exceptional methods of construction. Depressing gun carriages for a very plunging fire. Villantroys howitzer beds, those of the Belgian mortar of 60 c., &c.

Fifth Section.—Carriages and other Parts of an Artillery Train. Artillery of Foreign Powers.

Thirty-eighth Lecture.

12. Battery carriages. Ammunition waggon. Historical ideas on the subject. Requisites for carriages used for the transport of munitions of war. General arrangement and description of the present ammunition waggon. Principles of arrangement of the ammunition chest. Loading of the chest with munitions of various kinds. Mountain ammunition chest. Loading of the chest with howitzer ammunition and infantry cartridges.

Battery waggon; object of this carriage; patterns successively adopted. Description of the waggon, pattern 1833. Field forge; object of this carriage. Description of the forge in use. Arrangement and play of the bellows. Mountain forge. Description and loading of it. Carriages.

Thirty-ninth Lecture.

13. Park carriages and machines.

Park waggon. General arrangement and description of the park waggon and its limber. Carriages destined to the transport of heavy burdens. Ancient gun waggon. Truck. Block carriage. General arrangement and description of the carriage. Siege cart; its object and description. Devil carriages. Arrangement of the ancient devil carriages with perch and with screw. Devil carriage with roller. Description of the carriage and of its mechanism. Gin. General arrangement of the different patterns successively employed. Description of the gin at present in use. Handscrew; its use, general arrangement, and description.

Fortieth Lecture.

14. Pontoon equipages. Conditions which military pontoon equipages should satisfy. Considerations on the nature of the supports to be employed. Reserve pontoon equipage. Boat of the reserve equipage; its general form and dimensions. Description of the boat and skiff; use of the boat for navigation; its weight and different properties. Pontoons.

Tackle and machines employed for bridge-making. Balks, moorings, chesses, blocks, and balk collar. Framework, with moveable head; different kinds of piles. Means of anchorage. Common anchor; its properties. Anchor basket and chest. Buoy. Cordage.

APPENDIX I.—3. Artillery.

Ideas on its arrangement and on the measure of its resistance. Capstan. Windlass. Tackling. Handscrew. Pile driver. Hand rammer. Grapnel and hooks.

General arrangement of the boat carriage. Description. Its weight and properties. Light equipage.

Forty-first Lecture.

Artillery of different European powers.

15. General ideas on the artillery of the different European powers, and comparison with the French material.

Ordnance; description, species, and calibres. Gun carriages, carriages and other parts of the train. General arrangement; facility of movement; modes of harnessing, &c.

SIXTH SECTION.—DETAILS OF CONSTRUCTION OF GUN CARRIAGES AND ARTILLERY CARRIAGES, AND MEANS OF PRESERVATION OF MATERIAL.

Forty-second Lecture.

Wood.

16. Knowledge of woods. Preliminary ideas. Structures and general properties of woods. Diseases and defects of woods. Description and properties of the principal substances employed in the construction of the material; uses to which the different kinds of wood are specially destined. Selection of standing timber; felling; transport; reception of woods; cubature. Cutting up in large and small sizes. Observations on the shrinking of wood. Preservation of woods. Drying in the air. Round, squared, and blocked-out timber. Preservation in store; preservation in water. Steeping. Influence of the contact of woods with other woods, and with metals.

Forty-third Lecture.

Materials.

17. General considerations on the substances employed in the manufacture of gun and artillery carriages. Different properties of metals. Choice of kinds of wood; effects of their being dried. Classified account of axles and wheels. Axles; substance employed, their forms and dimensions. Wheels; essential requisites. Importance of the elasticity of wheels. Effects of the dishing of a wheel, form of the spokes, coupling of the spokes with the nave and the felloes. Tires. Form and number of the felloes determined by the effects of the drying. Form of the nave. Wheelboxes.

Forty-fourth Lecture.

Modes of connexion of parts.

18. Means employed for the connexion of the pieces which enter into the composition of gun carriages, carriages, and other furniture of the train. Nails, clinch nails, rivets, bolts, screws, &c. Examination of the joinings employed in the construction of gun carriages, carriages, and other furniture of the train.

General principles. Joinings of gun carriages. Joint plates (*"rondelles d'assemblage"*). Mortar beds, siege, field, and garrison carriages.

Forty-fifth Lecture.

19. Joining of other carriages and furniture. Hind parts, ammunition waggon, battery waggon, forge, park waggon, block carriage, cart, devil carriage, and drays. Boat and wherry. Fore parts, particular requisites. Fore parts of the field and siege carriage, of the park waggon, devil carriage, and drays. Barrels and cases.

Forty-sixth Lecture.

Preservation of Material.

20. Means employed for the preservation of the material. Cost price of the principal parts of the material. Ordnance, projectiles, powder, carriages, and other furniture of the train. Small arms. Preservation of ordnance in gun metal and cast iron. Preservation of projectiles. Formation and counting of piles. Rust-cleaning machine. Preservation of gun carriages, carriages, and other furniture of the train. Different methods of stacking in use. Preservation of powder and made-up ammunition; stacking in powder magazines. Means proposed for avoiding the danger of explosion. Preservation of small arms. Armouries. Preservation of iron and cut wood.

THIRD PART.

FIRE OF ORDNANCE AND PORTABLE FIRE-ARMS. EFFECTS OF PROJECTILES.

Forty-seventh Lecture.

Fire of Ordnance.

1. Fire of ordnance. Kinds of fire in use with ordnance. Choice of charges of powder. Charges of powder formerly in use; their progressive reduction. Charges of field, siege garrison, coast, and ships' cannon; of howitzers and mortars.

Arrangement of the charge. Shot cartridge for field guns. Loading of the other kinds of guns, of howitzers, mortars, and the stone mortar. Loading for fire with red-hot shot. Armaments for the service of ordnance. Methods of igniting the charges of

Artillery.

powder; tubes formerly in use, friction tubes. Percussion system; Swedish tube. Ignition of the charge of hollow projectiles, fuses of hollow projectiles, fuse with several pipes for the fire of spherical case, hand grenade fuse. Rapidity of fire. Laying of ordnance. Principal methods of laying guns; laying them by the help of the line of sight. Determination of the elevation. Instruments in use to obtain elevations. Negative elevations, means of using them. Laying guns for fire parallel to the ground; for breaching fire at a short distance.

Forty-eighth Lecture.

Laying Ordnance.

2. Determination of elevations by experiment; construction of practice tables. Laying guns when the axis of the trunnions is not horizontal. Laying guns with the help of the plumb-line and quadrant; plunging fire, rectification of the aim.

Fire of mortars, means for directing it in use; use of pickets, of the line, of the quadrant. Laying pieces in the case of a defective platform. Means of laying them for night-firing. Laying naval ordnance; use of the front sight. Initial velocities of projectiles withthe different charges in use. Angles of sight, and point-blank ranges of ordnance. Ranges at different sights. Maximum ranges.

Forty-ninth Lecture.

3. Probabilities in the fire of ordnance; known laws, facts ascertained by experiment. Distribution of projectiles over an object aimed at of indefinite extent. Mean point of impact. Fire of canister; effects of the dispersion.

Fire of spherical case. Effects of the bursting of the projectile; dispersion of the balls and of the explosions. Fire of the stone mortar; use of mortars for the same purpose.

Fire of small arms: charges of powder adopted. Ball cartridge. Initial velocities of balls with the different arms. Angles of sight and point-blank ranges. Rules for fire according to distances, for muskets, carbines, and pistols. Fire of rifled arms; use of the tangent scale. Probability of the fire of small arms; comparison of arms with smooth-bored and rifled barrels. Different means employed for the estimation of distances.

Fiftieth Lecture.

Effects of projectiles.

4. Effects of projectiles on the different substances fired at. Effects of concussion and penetration. Effects on earth. Theory of the penetration of a projectile into a resisting medium. Formula to express the penetration, based on the results of calculation and experiment. Effects of penetration into wood. Effects on metals, cast-iron, iron, lead. Effects on masonry and on rock. Application to a breeching fire delivered in a regular direction relatively to the revetment. Effects of the shock of projectiles upon living bodies. Effects of hollow projectiles bursting in different media; earth, wood. Method of bursting employed against troops.

Effects of spherical case. Incendiary effects. Effects of war rockets. Explosive rockets. Incendiary rockets. Effects of concussion.

FOURTH PART.

Trace and Construction of Batteries.

Six Lectures, common to the Students of both Arms.

Fifty-first Lecture.

Trace and Construction of Batteries.

1. Definitions. Meaning attached to the word "battery." Different denominations given to batteries; first, according to the circumstances of the war in which they are employed; secondly, according to their mode of construction; thirdly, according to the kind of ordnance with which they are armed; fourthly, according to the kind of fire for which they are intended; fifthly, according to the direction of their fire.

Principles of construction. General considerations on the elements which constitute the different kinds of batteries which have reference to them. Epaulment; its length, height, and thickness in different cases. Section of the epaulment. Ground-plan of the epaulment of the different kinds of batteries; returns at its extremities. Case where the battery is in advance of a parallel. Epaulment with redans; its trace.

Embrasures opened in the epaulment; their construction in different cases; slope of the bottom; interior opening; exterior opening; form of the cheeks.

Genouillère; fixing of its height for the different kinds of fire. Limit of the obliquity of the embrasures.

Fifty-second Lecture.

Terre-plein.

2. *Terre-plein;* its position relatively to the ground; its length for the different kinds of batteries. Disposition of the part unoccupied by the platforms. Terre-plein of garrison, field, coast, and barbette batteries.

APPENDIX I.—3. Artillery.

Ditch: cases in which it is employed. Its position with reference to the epaulment. Depth, breadth, section, and plan of the ditch.

Communications between the battery and the works in its neighbourhood; parallels or trenches; plan and construction. Communication between the battery and its ditch.

Powder magazines: their object. Discussion respecting their site and capacity with a view to the different kinds of batteries, viz., siege, garrison, and field batteries.

Traverses of *crownwork* and garrison batteries. Width between them and dimensions.

Fifty-third Lecture.

Details of Construction of Batteries.

3. Details of construction. Different materials employed in the construction of batteries. First, materials for revetments, fascines, gabions, hurdles, sods, bags of earth, withy-bands, stakes, &c. Secondly, materials for platforms: hurtoir, sleepers, planks, beams, pickets. Construction of revetments of different kinds employed in batteries. First, revetment of the interior slope of a battery upon the natural ground. Secondly, revetment in use when the terre-plein is more or less sunken. Ordinary siege battery, battery in a parallel, battery in a crownwork. Third, revetment of the cheeks of embrasures in the different cases met with in practice; direct batteries with point-blank range; ricochet, breaching, garrison, and field batteries.

Fifty-fourth Lecture.

Platforms.

4. Construction of platforms. Ordinary siege platforms, moveable platforms (*à la Prussienne*), garrison and coast platforms, ordinary mortar platforms, platforms for coast mortars of great range. Peculiar case where the fire has to be elevated or greatly depressed. Construction of the communications from the battery to the parallel and to its fosse. Construction of powder magazines in batteries. Magazines of siege batteries, Nos. 1, 2, 3, 4. Case of breaching batteries; garrison battery and field battery. Magazines. Degree of resistance offered by blinded magazines. Modifications adopted for the strengthening of magazines whose construction is already fixed.

Fifty-fifth Lecture.

Employment of Workmen.

5. Number of workmen to be employed on the construction of the different parts of batteries: revetments, platforms, communications, powder magazines. Earthworks.

Duration of the total labour necessary for the construction of each kind of battery. Duration of the duty for the different parts of the *personnel* employed upon the construction; officers, gunners, assistants. Definitive number of workmen necessary for the construction of the different kinds of batteries. Tools of different kinds.

Simultaneous execution. Preliminary operations. Reconnaissance. Prolongations. Sketch of the plan of a battery. Formation of the working party. Transport of materials. Plan of the battery. First, battery having its terre-plein on the level of the ground. Disposition of the working party. Work of the first night, of the following day, of the second night. Second, a battery sunk outside a parallel. Third, battery in a parallel or trench of some kind already established. Day labour, night labour.

4. Particular case of crownwork batteries.

Fifty-sixth Lecture.

Exceptional Constructions.

6. Exceptional constructions. Blinded batteries for cannon or howitzers; for mortars. Batteries of earth-bags. Batteries on stony ground, on the rock, or marshy soil. Floating batteries. Construction on sites deficient in space. Case where the fire of the place is too dangerous. Coast batteries. General arrangement.

Instruction preparatory to working at the plans of batteries. (Course.)

FIFTH PART.

Uniform Organization and Service of the Artillery.

Ten Lectures common to Students of both arms.

First Section.—Uniform Organization of the Artillery.

Fifty-seventh Lecture.

History of Artillery.

1. Historical résumé. Progress of modern artillery, from its origin down to our time.

Artillery of Charles VII. and of Louis XI. Progress under Francis I. Effects of the wars of religion. Edict of Blois, 1572. Improvements by Sully. Creation by Gustavus Adolphus. State of the artillery under Louis XIV. Emplmoyent of artillery on the field of battle at the commencement of the 18th century. Regulation of 1732. Introduction of howitzers into the French artillery. Regimental pieces. Progress of the

artillery in Prussia and in Austria in the Seven Years' War. Reorganization of the French artillery in 1765. Résumé of the improvements owing to Gribeauval. System of the year XI. Present system.

Historical ideas on the personnel of the artillery. State of the personnel at the commencement of the use of fire-arms. Masters and grand masters of the artillery, &c. Personnel employed originally on the service, and the guard of ordnance. Creation by Louis XIV. Account of the successive modifications in the personnel from this epoch down to 1765. Organization of 1765. Horse artillery. Pontoneers. Artillery train. Artillery of the Imperial Guard. Organisation of 1829. Present state of the personnel. Regiments of artillery. Composition of the personnel of the different kinds of batteries. Companies of pontoneers, workmen, armourers, veteran gunners. Driver-corps (*"train de parc"*). Naval artillery.

Fifty-eighth Lecture.

Artillery Establishments in France.

2. Committee and central depôt of artillery. Organization of artillery commands Establishments for the instruction of the personnel; artillery schools. Creation in 1679 Present schools; personnel attached to them. Central school of military pyrotechnics Establishments for the preservation of the material. Importance of the material of artillery. Its state in France at different epochs. Artillery directions. Division of the territory of France. Personnel of the directions.

Establishments for the manufacture of the material. Ideas on the subject of their management. Arsenals; their object, management, number, personnel. Forges; their object, management, districts, personnel, inspection. Foundries for land artillery; their number, management, personnel, inspection. Naval foundries. Manufactures of arms; their special management, number, personnel, inspection. Branch of the service connected with gunpowder and saltpetre. Powder manufactories and refineries; management, personnel. Direction of the service. Establishments existing in France. Percussion cap manufactory.

Second Section.—Service of the Artillery in the Field. Organization of the Field Artillery Train, &c.

Service of Artillery in the Field.

Selection of ordnance, conditions which determine it; cannon, howitzers, relation between them. Proportion of the number of pieces of ordnance to that of the combatants. Mean proportion received in France; circumstances which may lead to a modification of it. Organization of ordnance in batteries. Account of the arrangements formerly adopted. Present system. Distribution of the batteries in the army. Principles received. Application of these principles to the artillery train of an army of a given strength. Infantry divisional batteries; cavalry divisional batteries; reserve batteries. Case of the formation of army corps. Composition and supply of batteries. Principles and details of the supply of batteries with ammunition for the guns and for the troops. Second supply distributed amongst the parks.

Fifty-ninth Lecture.

3. Field parks. Their composition, in carriages of all kinds. Application of the principles to the artillery train of an army of a given strength. Approximate relation of the number of the carriages and of the horses of the train to that of the pieces of ordnance. Means of renewing the supply of the parks.

Personnel of the field train. Personnel of the batteries; working companies. Companies forming part of the train. Personnel attached to the parks. Staff. Particular conditions, having reference to war in a mountainous country. Selection of pieces of ordnance. Proportion between their number and that of the combatants. Composition of some artillery trains employed in our African expeditions. Composition and supply of the mountain battery. Lading of the mules. Composition of pontoon trains. Reserve train, boats, wherries, tackle, carriages, and horses. Personnel of the train. Light train: material, personnel.

Sixtieth Lecture.

March of Artillery.

4. Marches of the artillery. Reception of a battery or of a park. Precautions to be taken before the departure. March at a distance from the enemy. Order of march. Distribution of the personnel; halts. Case of an accident to a carriage; ascents; descents; deep-bedded roads; passage through inhabited places; passage of bridges; of fords. Passage over ice. Night march. Transport of mountain artillery. March of pontoon trains. Transport of the trains by water; navigation by convoys; by isolated boats. Transport of ordnance, powder and projectiles in the boats. Transport of artillery trains by sea.

March in the vicinity of the enemy. Isolated convoys; rule with reference to their command; order of march; general measures of security; precautions to be taken during halts; manner of receiving an attack. Case where resistance becomes impossible; arrangements for the night.

Artillery in the march with other troops. Order of march. Relation of the different corps to each other. Exceptional difficulties which may occur on marches; privations of

APPENDIX I.—3. Artillery.

all kinds; bad weather; bad state of the roads; instances. March among high mountains; passes strongly occupied by the enemy; examples.

Encampments and bivouacs. Choice of ground convenient for a camp; disposition of the artillery camp. Establishment of artillery bivouacs. Disposition of the park; precautions relating to the superintendence. Different measures to be taken on arriving on the place of encampment or of bivouac. Attention to be paid to the horses; special precautions for the mules of the mountain artillery. Precautionary measures variable according to circumstances.

Sixty-first Lecture.

Artillery in action.

5. Artillery on the field of battle. Measures to be taken on arriving in the neighbourhood of the enemy.

Choice of positions adapted for artillery.

1. Different considerations relative to the ground to be occupied; form of the ground; cultivated lands; nature of the ground; communications, &c.
2. Position of the artillery relatively to the enemy.
3. Position of the artillery relatively to the troops to be supported.

Execution of the fire. Choice of the different kinds of fire according to the nature of the object aimed at and the distance. Fire of cannon, with ball, with shot. Fire of field and mountain howitzers. Fire parallel to the ground.

Use of war rockets. General principles relating to the effects to be produced by artillery, and to the warmth of the fire. Proper use of stores; their replacement. Use of the prolong. Arrangements to be made after the engagement. Spiking and unspiking of ordnance.

Use of artillery in the principal circumstances of a campaign. General case of an offensive engagement. Part played by the artillery in supporting infantry and cavalry marching to the attack. Importance of the artillery for following up a first advantage which has been obtained. Examples. Use of the artillery in masses to strike a decisive blow. Examples. Defensive engagement.

Disposition and use of the artillery for the defence of fortified positions. Attack of entrenchments. Reconnaissance. Disposition and use of artillery; attack of lunettes by the gorge. Examples. Attack and defence of villages; disposition of the artillery under these two circumstances. Attack of squares. Importance of artillery towards preparing for it. Examples. Defence of squares; disposition of artillery. Examples. Case of a charge of cavalry upon artillery. Use of artillery in the advanced guard, in the rearguard, in a retreat.

Use of artillery in the passage of streams. Examples. Use of artillery to defend or force the passage of valleys or defiles. Examples.

Third Section.—Service of Artillery in the Attack and Defence of Places, and in the Defence of Coasts.

Sixty-second Lecture.

Service of Artillery in Attack and Defence.

6. Object to be attained with the use of artillery in the attack of places. Selection of ordnance, cannon, howitzers, mortars. Composition of the siege train. Method to be followed in order to determine it. Examples of trains employed in different sieges. Carriages of the train. Supply of the siege train with projectiles, powder, &c.

Personnel of the siege train; troops and staff. Transport of the siege train. Horses to be employed. Limit in either direction. Employment of watercourses. Examples. Establishment of the train before the place. Encampment of the artillery force. Organization of the parks. Workshops, powder magazines, trench-depôts. Rules relating to the direction of artillery works. Commanding officers of attack.

Sixty-third Lecture.

7. Considerations on the different kinds of batteries to be employed in the attack of fortified places. Position of the batteries relatively to the point to be breached. Direct battery within point-blank range; enfilading battery, for a plunging fire, for direct fire within point-blank range, for plunging fire. Mortar batteries. Composition of the different kinds of batteries. Position of the directing lines of an enfilading battery, relative positions of the cannon, the howitzers, or the mortars. Position of the batteries relatively to the parallels and the rest of the trenches. Examination of the circumstances which affect the power of a plunging fire, command of the work over the battery; distance between and height of the traverses. Slope of the crests of the work.

General principles relating to the order of the works of the artillery, commencing from the opening of the trenches.

Times for the construction of the first batteries. Batteries of the first and second parallels. Use of field artillery to defend the flank of the attacks. Replacement of the fire covered by the advance of the works; batteries of the third parallel. Use of vertical fire. Mortars of 15c. Throwing of grenades. Breaching and counter batteries. Considerations relating to their position. Batteries in the covered way.

Case of a breach into an interior work. Composition of the breaching and counter batteries. Calibres to be used. Number of pieces of ordnance.

Ideas upon the operation of arming batteries. Precautions to be taken. Passage out of the parallels or trenches. March in the trenches; examples of some operations of this kind. Supply of the different kinds of batteries. Rule relating to their daily service. Firing of siege batteries. Opening of the fire. Direct fire within point-blank range. Plunging fire. Fire of mortars. Warmth of the fire by day and by night; mean consumption of material. Fire of breaching batteries. Effects to be produced. Height of the horizontal cutting, number of the vertical ones. Execution of the fire; fall of the revetment. Fire upon the counter forts. Fire to render the breach practicable; balls, shells, war rockets, facts ascertained by experiment.

Consumption of powder and projectiles, length of the operation. Breaching fire in a very oblique direction. Fire upon masked masonry. Breach into an unreveted work. Fire of counter-batteries. Bombardment. Case where it can be employed; manner of executing it.

Occupation of the place; arrangements which must be made by the artillery. Case of raising the siege. Case of its transformation into a blockade.

Sixty-fourth Lecture.

8. Service of artillery in the defence of places. Object to be attained with artillery. Selection of ordnance, guns, howitzers, mortars. Use of war rockets and arms of precise aim. Field artillery. Basis of the supply of fortified places. Projectiles, powder, small arms, various carriages. *Personnel* of the artillery. Troops. Staff.

Measures to be taken before the siege. Reconnaissances. Arrangement of the material. Organization of the *personnel*, of the duty by local divisions, of the workshops of all sorts. Precautionary armament. Basis of its organization. Supply of ordnance. Defensive armament. General principles relating to the armament of different kinds of works. Bastions, cavaliers, demilunes, approaches, &c. Organization of the armament. Traverses, embrasures, gun carriages to be employed. Powder magazines. Supplies. Service of pieces.

Employment of the artillery against the first works of the besiegers, against the construction and armament of batteries; against the besieging artillery. Partial disarmament in case of inferiority. Part played by artillery in sorties. Modification of the defensive armament in proportion to the progress of the attack. Last defensive armament. Principles relating to its disposition. Armament of the flanking part of the fortification. Increased use of vertical fire. Use of war-rockets against works in close proximity. Crowning batteries, cavaliers of the trenches. Heads of saps, &c. Blinded batteries. Conditions of the establishment. Defence of breaches.

Service of artillery in the defence of coasts. General considerations on the degree of extension admissible in the armament of coasts. Principal points to be defended. Selection of ordnance intended for the armament of coast. Objects to be effected. Effects of balls (utility of large calibres); of howitzer shells and of shells. Fire with red-hot balls. Material appropriated to the defence of coasts.

Position of coast batteries, conditions which determine it. Composition of coast batteries; their supply. Ideas upon the organization of the batteries and their small redoubts (*réduits*). Use of the fleet and of field artillery. *Personnel* allotted to the service of artillery on the coasts.

Fourth Section.—Application of the Principles previously set forth to the Attack and Defence of the Fortress of Metz (Sham Siege).

Sixty-fifth Lecture.

Composition of the siege train necessary for the attack of Metz. Carriages of the train.

Supply of the train with projectiles, powder, &c. Personnel of the train, troops and staff. Transport of the siege train. Establishment of the train before the place; encampment of the artillery force. Organization of the parks. Workshops, powder magazines and depôts.

Sixty-sixth Lecture.

10. Object, disposition, and armament of all the batteries from the first opening of the trenches to the capture of the place. Use of field artillery to flank the batteries, &c

Service of artillery in the defence of the place. Supply of ordnance, projectiles, powder, small arms, and different carriages.

Personnel of the artillery. Troops, staff. Organization of the personnel and of the duties by local divisions. Precautionary armament; supply of ordnance. Defensive armament. Armament of the different works. Service of the pieces. Last defensive armament.

Lectures preparatory to the Labours of the Course.

1. Drawing and tracing of ordnance	-	3 lessons.
2. Design for ordnance	-	4 „
3. Application of the theories of the course	-	1 „
4. Drawing of artillery material	-	1 „
5. Tracing of batteries	-	„ „

APPENDIX I.—3. Artillery.

The sixth lecture of the fourth part of the course (the fifty-sixth) is partly devoted to the communication of the instructions necessary for the execution of the work of tracing plans of batteries.

Studies in connexion with the Artillery Course.

The practical studies which are connected with the artillery course, are,—

1.	Drawing of ordnance	12 days.
2.	The designs for ordnance	24 „
3.	The application of the theories of the artillery course	6 „
4.	The drawings of artillery material	26 „
5.	The tracing of batteries	4 „
	Total	72 days.

Division of tasks between Artillery and Engineer Students.

The tracing of batteries is executed by the students of both arms, the other tasks by the artillery students alone.

I.—Drawing Ordnance (12 Days).

Drawings of Ordnance.

The survey of ordnance consists in constructing accurate sketches of a gun, howitzer, and mortar, in measuring their dimensions, and in giving a description of each of the pieces drawn. It is on this occasion that the students are practised in the management of instruments to ensure precision, such as the *étoile mobile*, and the sliding compass, &c. One day is devoted to this work.

The tracing of ordnance consists in the execution of a drawing upon colombier paper, containing an exact and detailed representation of a gun, a howitzer, and a mortar, with their projectiles.

This work is performed with the help of the tables for the construction of ordnance. Eleven days are devoted to it.

Detailed Programme of the Drawing.

1. For each gun, howitzer, or mortar, a longitudinal section in the direction of the axis, and at right angles to the axis of the trunnions, and a plan parallel to the axis of the bore and of the trunnions.

Besides this, for those cannon and howitzers which have dolphins, a transverse section taken across the middle of the dolphins and the axis of the trunnions. For mortars, a transverse section made by a plane passing in front of the dolphins, the whole on a scale of one-fifth.

2. Detail of the button (comprising the cascable and breeching loop for naval ordnance) on a scale of two-fifths.

3. Detail of the tracing of a dolphin, on the scale of two-fifths.

4. Tracing of the bush of a gun, on a scale of two-fifths, and tracing of a priming-pan at the real size.

5. For garrison ordnance, in cast-iron, detail of the widening of the base ring on a scale of two-fifths.

6. Tracing of a cannon-ball, of a howitzer-shell, and of a shell, on a scale of one-fifth.

Tracing of the lugs of a shell, ring and lug at the real size.

All the parts of the drawing must be coloured in uniform tints in conformity to the table of conventional colours; the annexation of the figures of measurement is not required.

This work is preceded by three or four lectures intended to make the students familiar with the tracings which they have to execute, and the solution of the problems in geometry and descriptive geometry, to which the representation on paper of pieces of ordnance and their projectiles give rise.

II.—Design for Ordnance (24 days).

The design for ordnance has for its object the complete determination of the nature of a projectile, and of a piece of ordnance in accordance with certain special conditions, inquiring into the laws of the motion of the projectile, and into its principal destructive effects, and the settlement of practice-tables for the gun. The general case for treatment is that of a howitzer, which comprehends the gun and the mortar as particular cases.

The data usually adopted are,

1. For the projectile, its weight and the quantity of powder which it is capable of containing.
2. For the piece, the initial velocity of its projectile. This operation comprises calculations, a drawing, and a memoir.

The drawing, on colombier paper, which must be figured in all its parts, contains,—

1. The tracing of the profile of the piece, as it is determined by calculation, so as to satisfy the different conditions of resistance, on a scale of one-fifth.
2. The complete tracing of the piece executed in conformity with the rules laid down for the tracing of ordnance on a scale of one-fifth.

3. Tracing of the projectile on a scale of one-fifth.
4. Tracing of the wooden bottom and of the fuse of the projectile, executed in the case of each of these objects in two figures—the one on a large scale (two-thirds, or even the size of nature), representing the inquiry into their forms and dimensions, the other giving on a scale of one-fifth the results of this inquiry. To this is added, for the mountain howitzer, or any other howitzer for which it is admissible, a tracing of the mounted howitzer carriage.
5. The representation in drawing of the laws of the motion of the projectile, the trajectory, inclinations, remaining velocities, durations of the passage.

In addition, the scale of the elevations and that of the angles of fire, for an object of aim placed at different distances.

6. An inscription showing all the essential elements by which the projectile and the piece are distinguished.

The final tracings of the gun, the projectile, the bottom, and the fuse, must be coloured in uniform tints conformably to the table of conventional colours.

As to the tracing of the profile founded upon the calculation, it should receive merely an edging of the colour which represents the metal used.

Programme of the Memorandum on the Design for Ordnance.

Introduction.

Object of the work. Data of the Question.

Chapter I.—Projectile.

First Section.—Substance, Forms, and Dimensions.

1. Choice of the metal employed in the manufacture of this projectile.
2. Forms of the projectile.
3. Internal diameter.
4. External diameter.
5. Dimensions of the vent.
6. Diameters of the high and low gauges.
7. Densities of the projectile empty and filled with powder.
8. Weight of the cast-iron ball of the same calibre as the howitzer shell.

Second Section.—Minimum Bursting Charge.

9. Theoretical bursting charge for the hollow sphere.
10. Effect of the shock of the gases, and of their loss through the vent.
11. Résumé of the results arrived at in this chapter.

Chapter II.—Ordnance.

First Section.—Metal, Calibre, and Length of Bore.

12. Choice of the metal of which the piece is to be formed.
13. Windage of the projectile and diameter of the bore.
14. Effect of the windage on the velocity of the projectile.
15. Length of the bore and charge of powder which satisfy the data of the programme.
16. Résumé of the results arrived at in this section.

Second Section.—Thicknesses of Metal necessary in order that the Piece may resist the Expansion of the Gases.

17. Explanation of the method employed to resolve the question of the thicknesses of metal.
18. First propulsion of the projectile, mean density of the gases after this propulsion.
19. Second propulsion of the projectile, mean density of the gases after this propulsion.
20. Third, fourth, &c. propulsions of the projectile, mean density of the gases after each of them.
21. Density and position of the strata (of gas) at the moment of the maximum of mean density.
22. Density of the last stratum for the positions which come after that of the maximum of mean density.
23. Tensions which result from the densities found.
24. Corresponding thicknesses of metal.
25. Résumé of the results obtained.

Third Section.—Profile of the Piece.

26. Enclosing curve, resulting from the calculations of the second section.
27. Modification rendered necessary by the form of the posterior part of the projectile.

APPENDIX I.—3. Artillery.

28. Utility of the chamber and its dimensions.
29. Tracing of the chamber and of its junction with the bore.
30. Thickness of metal around the chamber.
31. Chase and reinforce.
32. Determination of the angle of sight.
33. Vent and base ring.
34. Minimum weight of the piece for the resistance of the carriage.
35. Approximate calculation of the weight given by the profile previously obtained. Modification of this profile, if there is any.

Fourth Section.—Trunnions, Breech, and Handles.

36. Dimensions of the trunnions and of the shoulders.
37. Tracing of the breech.
38. Base rings and other mouldings.
39. Object and fixing of the preponderance of the breech.
40. Exact settlement of the position of the trunnions, definitive length of the reinforce.
41. Centre of gravity of the piece; dimensions and position of the handles.
42. Means of executing the calculations indicated in the two preceding articles.
43. Table of the dimensions of the piece.

CHAPTER III.—FIRE OF THE HOWITZER. EFFECTS OF THE PROJECTILE.

First Section.—Elements of the Charging of a Howitzer.

44. Tracing of the shot bottom.
45. Tracing of the fuse.
46. Diameter of the cartridge (or of the bag).
47. Charge of powder for firing with ball.

Second Section.—Laws of the Motion of the Projectile. Establishment of Practice Tables.

48. Preliminary calculations.
49. Trajectory.
50. Curve of the inclinations.
51. Curve of the remaining velocities.
52. Curve of the durations of the passage.
53. Determination of the elevations for the fire at different distances.
54. Angle of fire, corresponding to the different distances of the object aimed at.
55. Angles of descent.
56. Résumé of the laws of the motion and of the practice tables.

Third Section.—Effects of the Projectile.

57. Depth of penetration in the media indicated by the program.
58. Effects of explosion in earth.
59. Résumé of the results relating to the effects of the projectile.

Note.—The formulas cited in the memoir need not be accompanied by their demonstration, except in the case of the latter not having been already developed in the lessons of the artillery course. It will be sufficient to insert in this notice only the final result of the calculation relating to each formula, without entering into the details of such calculation.

The study of the design for ordnance is preceded by four lessons intended to make the students acquainted with all the details of its execution, and the substance of which is indicated in the programme of the memoir.

III.—APPLICATION OF THE THEORIES OF THE ARTILLERY COURSE (6 days).

This study is intended to apply to the students those theories of the course which have not found their application in the design for ordnance. It comprises the solution by arithmetical calculations of certain questions on the effects of powder, the balistic pendulum, the effects of recoil, the science of projectiles, the draught of carriages, &c. The number of the questions may vary according to their nature and the time which their solution requires. The stating of the questions and the results of the calculations are inscribed on separate papers. This study is preceded by a lesson in which the students have recalled to them the formulas which they have to employ.

IV.—DRAWING OF ARTILLERY MATERIAL (26 days).

Drawing of Artillery Material.

The drawing of artillery material has for its object the representation by figured sketches of a gun carriage, carriage, or other furniture of artillery material. The sketches, on paper put together in the form of a book, and headed by a special program for the object to be drawn, consist of plans, sections, or elevations of the object, executed on certain scales, and of detailed projections of the principal ironwork and joints. The whole fixed by the special program in question.

All the simultaneous projections of any one part of the object drawn (fore part or hind part for carriages) must be completely figured; they are accompanied by explanatory inscriptions, with letters of reference to show the names of the pieces in wood or metal which they comprise.

Each collection of sketches must contain as well a notice in confirmation of the drawing, giving the complete description and the properties of the object to which it refers.

The students make two surveys of the same kind; eight days are allowed for each of these surveys, including the composition of the confirmatory notice.

The first survey is followed by the execution of an unfigured drawing, containing a complete representation of the object surveyed (elevation and plan), obtained by the combination of the partial projections contained in the sketch. The drawing should be coloured in the conventional uniform tints, and accompanied by an explanatory inscription, with letters of reference. Ten days are devoted to this work of composition.

V.—Tracing of Batteries (4 days).

Tracing of Batteries.

This work consists in executing sketches showing, each in accordance with a separate program, the complete plan of a battery and the essential data having reference to its construction and to its armament. The sketches, made by scale and completely figured, must comprise in the case of each battery to be represented—

1. The general plan of the battery, on the scale of $\frac{1}{200}$.
2. The sections or elevations necessary for the understanding of this plan, including the detail of the powder magazines, lines of communication, &c., on the scale of $\frac{1}{100}$.
3. An inscription giving the object of the battery, its armament, its general arrangement (*terre-plein*, embrasures, revetment, communications, magazines, &c.), the workmen, materials, and tools necessary for its construction, and finally the duration of the labour and its distribution by day and night.

Four days are devoted to this work, which must be executed on a half sheet of colombier paper. The separate programmes relating to each of these batteries are shown on the study orders of the rooms.

Recapitulative Table.—Artillery Students.

Recapitulative Table: Artillery Students.

Lectures.	Number of the Lectures.	Credits given for the Lectures.		Total Credits.	Number of the Questions.	Observations.
		With application at 1h 50m.	Without application at 3h.			
Division of the Course—						
1st Part. Theory, Sect. 1, 2, 3.	26	18	42	60	4	
2d Part. Description of the Material, Sect. 1, 2, 3, 4, 5, 6.	20	30	—	30	3	
3d Part. Fire of Ordnance	4	—	12	12	1	
4th Part. Construction of Batteries.	6	9	—	9	1	
5th Part. Organization and Service of the Artillery, Sect 1, 2, 3.	8	—	24	24	1	
Sham Siege - - -	2	3	—	3	—	
Lectures in preparation for the Studies.	9	13 50	—	13 50	—	
Totals - -	75	73 50	78	151 50	10	

APPENDIX I.—3.

Artillery. Recapitulative Table: Artillery Students.

Studies.	Number of: Sketches.	Drawings.	Memoirs.	Inventories.	In-door attendance, 4½ hours.	Out-door attendance, 1½ hours.	Credits in round Numbers.	Observations.
Survey of Ordnance	1	—	—	—	—	1	5	
Tracing of Ordnance	—	1	—	—	11	—	50	
Design for Ordnance—								
Calculations	—	—	—	1	10	—	45	
Drawing	—	1	—	—	8	—	35	The time is doubled for the Memoirs.
Memoir	—	—	1	—	6	—	55	
Application of Theories—								
(Artillery Questions)	—	—	1	—	6	—	55	Ditto.
1st Survey of Materiel—								
Sketch	1	—	—	—	—	8	35	
Composition of Notice	—	1	—	—	10	—	45	
2nd Survey—								
Sketch	1	—	—	—	—	8	35	
Sketch of Batteries	1	—	—	—	4	—	20	
Totals	4	3	2	1	55	17	—	

Recapitulation.

Lectures	150	530
Studies	380	

Recapitulative Table: Engineer Students.

Recapitulative Table.—Engineer Students.

Lectures.	Number of the Lectures.	Credits for the Lectures: With application at 1h 50m.	Credits for the Lectures: Without application at 3h.	Total Credit.	Number of the Questions.	Observations.
Division of the Course—						
1st Part. Theories, Sect. 1, 2, 3.	24	—	72	72	4	
2d Part. Description of the Material, Sect. 1, 2, 3, 4, 5, 6.	14	—	42	42	2	
3d Part. Fire of Ordnance	4	—	12	12	1	
4th Part. Construction of Batteries.	6	9	—	9	1	
5th Part. Organization and Service of the Artillery, Sections 1, 2, 3.	8	—	24	24	1	
Mock Siege	2	3	—	3	—	
Totals	58	12	150	162	9	

Studies.	Number of: Sketches.	In-door Attendance.	Credit.	Observations.
Sketches of Batteries	1	4	20	

Recapitulation.

Lectures	162	182. Round number, 180.
Studies	20	

4.—PROGRAMME OF THE COURSE ON MILITARY ART AND FIELD FORTIFICATION.

Military Art and Field Fortification.

The course is divided into six parts, and is made up of lectures and of works of Application in the Halls of Study and on the Ground.

1. Lectures.

The first part contains sundry historical notices on the organization of armies	-	6 Lectures.
2nd part is on Tactics	-	3 „
3rd „ Castrametation	-	2 „
4th „ Field Fortification	-	16 „
5th „ Military Communication	-	10 „
6th „ Strategy	-	6 „
Total	-	43

First Part.—*Historical Notices on the Organization of Armies.*

Historical notices on the organization of Armies.

The first lecture commences with explanations relating to the Greek and Roman armies; their order of battle, mode of marching; comparison of the Roman Legion with the Greek Phalanx, and of the Roman Legion under Marius and under the Emperors.

2. Military organization of the Franks under the Kings of the first race. Consequences of the feudal system, acting on the military organization. Feudal armies. Chivalry. Crusades, and war against England. Establishment of the first standing armies. Results dependent on the introduction of fire-arms. Progress made in the Art of War and in the organization of armies, from the sixteenth century to the present time.

Standing Armies.

3. Necessity for standing armies. Their proper character. Recruiting. Promotion. Degrees of rank. Station of the Officers. Various positions of military men. On the composition of armies, Infantry, Cavalry, Artillery, Engineers. *Corps d'Etat-Major.* Composition of the army during the Revolution and during the Empire. Actual formation of a French army.

General Staff. Commissariat. (*Intendance.*)—Different services dependent on it.

Relations between the strength of each of the arms that make up an army. On other corps which are not classed among the principal arms.

Military organization of principal powers of Europe.

4, 5, 6. Summary relating to the military organization of the principal Powers of Europe.

Second Part.—*On Tactics.*

Tactics.

1. Definitions. Formations. Manœuvres; character of a good manœuvre. Order of battle; first, of the Infantry; second, of Cavalry; third of the Artillery; relating to Sharpshooters (*tirailleurs*).

2. Brief summary of the principal movements in battalion drill to pass from line to the order in columns and reciprocally. Movements in column. Movements in battle. Dispositions to be made against cavalry.

The three Arms.

3. Of the principal movements in line. Order of battle. Line of battle. Formation of Infantry to advance against the enemy. Action of Cavalry. Principal formations. Charges of Artillery. Use of the Three Arms.

Third Part.—*Castrametation.*

Castrametation.

1. General principles of castrametation. Situation. Construction and disposition of barracks. Camp of a Regiment of Infantry, of Cavalry, and of a Battery of Artillery.

2. Manner of tracing a camp on the ground. Huts; details relating to their construction. Tents. Bivouacks. Screens. Kitchens and camp ovens. Choice of the site of a camp; precautions to be taken for its security. Main guards. Advanced posts. Patrols and sentinels.

Fourth Part.—*Field Fortification.*

Field Fortification.

1. Definition of fortification in general. Object and character of field fortification; its utility demonstrated by historical examples. Napoleon's opinion. Essential principle of field fortification. Discussion on the ordinary profile of earthen entrenchments; on the dimensions to be given to the ditch in level ground.

2. Definitions relating to the trace; general principles. Redoubts.

3. On the elements of lines. Relation that should exist between the crest and the internal size of a closed work. Maximum and minimum of the sides of a square redoubt. Defects inherent to the trace of this kind of redoubt. Circular redoubts. Redoubts *en crémaillères.* Star Forts. Lines with bastions.

Revetments.

4. Revetments of various kinds; case in which the slope of the ditch should be reveted; choice to be made of the different kinds of revetments.

Exterior dispositions.

5. Exterior dispositions; accessories to the defence; abattis; *trous de loups;* palisades; *chevaux de frise,* &c. Precautions to be adopted with reference to such accessories.

APPENDIX I.—4.

Military Art and Field Fortification.

6. Interior dispositions; armament of musketry, artillery, barbettes, and embrasures; their advantages and disadvantages; construction of.

7. Powder magazines of different kinds. Small earthen entrenchments; palisades, carpentry, or blockhouses; advantages and disadvantages of blockhouses. African blockhouse. Closing of field-works.

Inundations.

8. Artificial inundations; under what circumstances they can be considered as obstacles. Positions and dimensions of dikes. Details of their execution; what advantage can be drawn from an inundation having less than five feet depth of water.

Defilade.

9. What is understood by the defilading of a work. The defilading of fieldworks should, above all things, be made to depend on their trace and situation. Definitions: dangerous ground; dangerous points. Defilement of an isolated and closed work; in what case it is practicable. Use of traverses. A partial defilement may sometimes be sufficient.

Lines continuous and broken.

10. Continuous lines. Broken lines. Traces of redan, tenailles, cremailleres. Bastioned lines, Comparison between continuous and broken lines. Principal objections to their use. Utility of each demonstrated under certain circumstances.

11. Lines in broken ground: their form should depend on the nature of the ground. On the manner of fortifying a table land. Expedients for defilading portions of lines. On the manner of making use of the natural obstacles of the ground; forests, scarps, marshes, watercourses, &c. Method of fortifying a house, village, an open town. Defence of a bridge or road.

Tête-de-pont.

12. *Têtes-de-pont.* Utility of small earthen entrenchments in these cases to facilitate the passage of a retreating army. Traces of a large *tête-de-pont.* Principal circumstances relating to the use of Lines in war. Lines of circumvallation and countervallation. Frontier lines. Retrenchments against a descent. Lines that an army should make in an enemy's country, far from its base of operations. Entrenchment on the field of battle. Lines, mixed, proposed by General Rogniat.

Attack and Defence.

13. Attack and defence of entrenchments, of a continuous line; of a line at intervals; of an isolated work, &c. Examples of the attack and defence of lines.

14. Instruction relating to the operations for profiling and defilading on the ground.

Project of Field Fortification.

15. Instruction on the project of field fortification. Calculation of the dimensions of a ditch corresponding to the face of a work of a variable relief, and to be constructed in level or other ground. Details relating to traverses, small entrenchments; defensive caponnieres, and accessories to defence, &c.

Construction of ntrenchments.

16. On the construction of intrenchments. Practical operations and organization of workshops to obtain durable and solid work. Necessity, in most cases, for accelerating the construction of entrenchments. Vauban's precepts. In what manner the work must proceed to obtain a useful result; and, in the event of plenty of hands, how to finish it promptly.

Fifth Part.—*On Military Communications.*

Military communications. Roads.

1. On roads. 1 and 2. Classification of roads. Section and trace of roads in level and mountain country. Details connected with the study of a project for a road. Particular conditions relating to military roads. Execution of paved and macadamized roads. Roads for passing difficult places by the use of fascines, logs, &c. Maintenance and destruction of roads.

Military bridges.

2. On Military bridges.

3. Observations on the currents and change of form in the bed of rivers. Fords. Transverse sections, &c. Reconnaissances of rivers. Properties essential to military bridges. Relation between the buoyancy and the load in the case of floating supports. Anchorage. Construction of the abutments. Means of rendering bridges stable.

Bridge of boats.

4. Construction of a bridge of boats in different ways. Bridges made of ordinary boats. Method of withdrawing a bridge of boats.

Raft bridge.

5. Raft bridge. Relation between the weight and the extrinsic load of a raft. Number of trunks of trees required for a raft bridge on a river of given dimensions. Weight of the trunk of a tree. Number and space between rafts. Construction of a raft and a bridge of rafts. Bridges of casks and trestles.

Rope bridge.

6. Rope bridges; their use. Calculations respecting the tension and diameters of ropes. Construction of a suspension bridge, and calculations relating to it.

Other bridges.

7. Bridges on piles, carriages, gabions, &c.

8. Measures to be taken for the preservation of military bridges. Destruction of military bridges; also of masonry bridges. Re-establishment of bridges.

9. Flying bridges. Ferry-boats, tubs, passage by fords, on the ice, by swimming.

Passage of rivers.

10. Execution of the passage of rivers. Advancing and in retreating. Examples.

Sixth Part.—*Strategy.*

Strategy.

1. Definition. Fundamental principles of all operations in war. In all cases there are, first, the base of operations; second, the point to be arrived at; third, the line of operations. Strategetical points and lines.

Marching.

2. On marching. Preparatory and manœuvering marches. Advanced and rear guard. On provisions. System of magazines. Requisitions. Invasions. Battle. Examples.

Positions.

3. On positions. War in a mountainous district. Retreats. Pursuit. Convoys. Partizans.

4. Winter quarters. Cantonments. War against irregular bands. Military reconnaissances.
5. Precis of the campaigns of the French armies.
6. Analysis of the principal campaigns of great captains.

2. Programme of the Works of Application executed in the Halls of Study.

Drawings.

These works consist of four Plates of Drawings, two Memoirs, and a Project of Field Fortification. Of the four Plates of Drawings, two relate to Field Fortification, and two, accompanied by Memoirs, relate to Military Communications.

Plate 1.—Elements of lines. Tracing, on the scale of $\frac{1}{100}$ of the interior crest (only) of a redan, lunette, redoubt, star fort, bastionned fort, according to particular data given, to each Sous-Lieutenant. Construction on the scale of $\frac{1}{200}$ of a complete profile for each of these works, supposed to be established on level ground. Complete calculation of the deblais and remblais for one of the preceding works, according to the instructions of the Professor.

Plate 2. Details of a field-work. Trace on the scale of $\frac{1}{100}$ of a portion of the work of which the deblais and remblais has been calculated. Graphic construction of a barbette and of a direct or oblique embrasure. Details of revetments in fascines, hurdles, turf. Pisé. Drawing of a block-house.

Plate 3. Accompanied by a Memoir. Project of a portion of road on ground represented by certain lines, according to certain data.

Plate 4. Accompanied by a Memoir. Military bridges.

1. Drawing of a portion of a bridge of boats, three openings being shown; the two first relating to the successive construction of the bridge, and the third, of the construction by portions.
2. Project for establishing a raft bridge; the width of the river; the kind of troops to pass over the bridge; the length; mean diameter of the available trunks of trees and the length and scantling of the joints being given. The drawing to exhibit a plan of two openings of the bridge, and a transverse section.
3. Tressel bridge. To draw a longitudinal elevation and a transverse section of a tressel bridge, being given the length of the top and of the feet of the tressels up and down the stream.
4. Project for the repair of a broken arch; being given the opening of the head, the elevation of the roadway of the bridge above the level of the water; the depth of the water, the rapidity of the current, the kind of troops to pass over the bridge, and the available time and the resources as regards men and materials which can be had recourse to.

Programme of the Project of Field Fortification.

Project of a Field Fortification.

This project is made by the Sub-Lieutenants, according to certain data given to each of them. It has for its object to cause them to study:—1st. The trace. 2nd. The complete organization necessary for its defence. 3rd. The details of construction of a field-work. In consequence, the work comprises three Plates of Drawings and a Memoir divided into three parts.

Programme of the Drawings.

Plate 1. Plan of the whole. This plate has for its object the research of a trace and of a combination of suitable works for the fortification of a certain portion of ground under certaid circumstances of war defined by particular data. Each Sub-Lieutenant receives a lithographed sheet representing the ground to be fortified, and he has to exhibit on this sheet the works he proposes, in tracing in plain lines the horizontal projections of the interior crests and superior limits of the ditch, and in dotted lines the stockades or palisades;—to show in black figures at the angles of the works the relief of the interior crests; the sites of barbettes, embrasures, traverses, barriers, &c., being indicated by reference letters and explanatory notes, the lines in red showing the directions and objects of the line of fire.

Plate 2. Organization of a work.

This plate has for its object the study of the details of the interior and exterior organization of a work of a certain form, in order to render it susceptible of making a good defence.

Each Sub-Lieutenant will draw a complete plan of such one of the works shown on Plate 1, as may be pointed out by the Professor. He will represent the ditches, parapets, embrasures, accessory defences, small entrenchments, descents into the ditch, &c., according to the particular data furnished to him; the figures of the relief of the crests of all kinds, the deblais and remblais being marked at all the angles. The figures of the natural ground will be underlined. The same plate will contain figured profiles which have served for the determination of the complete projection of the work. Scale $\frac{1}{200}$.

Plate 3. Details of construction.

The object of this plate is to show the composition of workshops and the manner that should be adopted in the construction of field works, according to circumstances, for the execution of the deblais and remblais.

APPENDIX I. 4.

Military Art and Field Fortification.

Each Sub-Lieutenant will indicate the manner in which the work drawn on Plate 2 should be constructed :—1st, to render it durable and solid. 2nd, To arrive rapidly at a useful result, even with limited resources of workmen and tools. 3rd. To finish the work in the shortest possible time by making use of all the necessary means. A plan will show the composition of the workshops under each of these hypotheses, and the successive advancement of the work will be represented by certain profiles supposed to be made at certain periods of the construction through the centre of one of the faces of the work. In these profiles a firm trace, figured with altitudes, will show the limits of the deblais and remblais at the period represented by the profiles; and in addition, by dotted lines, the final results proposed to be obtained. All these projects must be accompanied by a figured plan, showing the principal altitudes in meters. The remblais will be coloured with gamboge, the undisturbed earth in bistre, and the deblais will be left white.

Program of the Memoir.

Each Sub-Lieutenant will write at the head of his Memoir the text of the particular program, to which he is obliged to conform in the preparation of his project, and he should add to the text of the Memoir all the sketches properly figured, which are necessary for the proper appreciation of the dispositions which are not sufficiently detailed on the Drawings.

The Memoir is divided into three parts, corresponding to the three Plates of Drawings.

First part.—*Considerations respecting the whole Project.*

1st. General principles, according to which it would be proper to trace the works indicated in the particular program, such as lines at intervals, continuous lines, têtes-de-pont, &c.

2nd. Description of the tracing in Plate 1. Reasons deduced from the form of the ground or the nature of the military operations that led to the adoption of the trace. Object of the works, and their connexion with each other.

3rd. Number, description, and position of the pieces of artillery composing the armament.

Project of a Field Fortification.

4th. Maximum and minimum of troops that could be employed in the defence of these works.

5th. Dispositions which should be adopted (relatively to the necessary preparations in materials and to the separation and movement of troops) for the attack and for the defence.

Second Part.—*Complete Organization of a Work.*

1st. Particular object of the work shown in Plate 2. Trace of the complete projections of the parapets, barbettes, ramps, embrasures, traverses, &c.

2nd. Conditions that should be fulfilled by the ditch. Approximate calculation of dimensions which should be given to it, taking into account the increased means of providing for an excess or defect of the deblais.

3rd. Discussion on the site and the part which might be expected from small entrenchments, accessory defences, shutters, descents of ditches, &c.

4th. Site of powder magazines; capacity that should be given to them, suitable to the state of the munitions necessary for the armament of the work.

Third Part.—*Details of Constructions.*

1st. Means of ascertaining the nature of the earth; considerations respecting relays for the transport of earth with the shovel.

2nd. Description, number and disposition of the workmen in a shed for deblai and remblai, according to the nature of the ground and number of relays.

3rd. Explanation of Plate 3. Organization of the sheds and conduct of the work where the duration and solidity of the work are the greatest essentials; where, on the other hand, rapidity of execution is the principal thing to be fulfilled.

4th. Which of the modes of construction exhibited in Plate 3 it would be desirable to employ for the proposed works, according to the circumstance specified in the particular program. Calculation for this mode of construction, of the time and of the numbers of men and tools necessary for the execution of the deblais and remblais of the work given in the plate.

5th. Details of construction of the revetments, magazines, shutters, accessory defences, artillery platforms, &c.

3. Program of Exterior Works.

These works consist of an exercise in tracing out a camp, and an exercise on the profilling and defilement of field-works.

The exercise on tracing camps has no particular program, but is preceded by a lecture given by the Professor.

Program of Practical Exercises on the Defilement and Profiling of Field works.

Practical exercise in defilement and profiling.

This exercise comprehends, 1st, work on the ground; 2nd, a Memoir.

The work on the ground has for its object, 1st, the trace of the projections of the interior crest of a work, whose position and form are known; 2nd, the determination of

the relief of the interior crest; 3rd, the profiling of the different parts, so that the relief of the different parts of the parapet, barbettes, traverses, &c. may all be fixed.

The Sub-Lieutenants for this kind of work are divided into groups of six or eight, employed together on the same work, each group being divided into two squads. The work may be a lunette or a redan of given dimensions, having a parapet of three metres thick, and a natural slope of one to one. 1st. The direction of the capital will be marked out in front by two numbered pickets. 2nd. The tracing will be executed by means of poles or pickets placed at all the angles, and at the extremities of the gorge; the relief will be determined by the practical methods of defilement adverted to in the lecture which preceded the work.

3rd. The relief obtained by the defilement will be marked on all the poles or pickets placed at the angles, and at the extremities of the sides of the work.

4th. On each face two vertical profiles will be executed, perpendicular to the horizontal projections of its interior crest. In order that these profiles shall not interfere with those placed at the angles, they must be established at several metres distant from the extremity of each face.

Practical exercise in defilement and profiling.

5th. The profiles of the angles will be deduced by simple prolongations, and the same for the profiles of the gorge. If the homologous crests of two contiguous faces do not meet each other, they should be reconciled by joining two points taken on each of them at half a metre from the intersection of their projections.

6th. On the traverse, designed to secure the defenders from a reverse fire, two profiles are constructed, near to its extremities if its crest is a right line, but if it is bent, another profile must be set up at the junction.

7th. The data of all these profiles are, the relief of the interior crest at the point where it is encountered by the profile, the thickness of the parapet, the constant parts of every profile, and the natural slope of the ground; the portion of the slope of the traverses exposed to the view of the dominant heights should not be reveted, the others should be.

8th. At the points of intersection of the profiles with the projections of the ridges of the works, as well as at the points used for adjusting, poles or pickets are placed, on which the points belonging to the ridges are marked. These points will be joined together in each profile by twine, indicating the different planes of the work.

9th. The form and dimensions of the batteries, either of barbettes or embrasures, will be equally determined by poles or pickets placed at all their angles, and united together by twine in the manner that will be subsequently explained.

10th. For the barbette batteries, the first thing to be done is to establish and to construct the front coupé of the salient of the interior crest, and substitute an interior horizontal crest throughout the extent of the barbette for that situated in the plane of defilement. The necessary adjustments are then made between the slope of the parapet of the barbette and that of the rest of the face, and indicate by means of twine the intersections of the terre-plein of the barbette and of its slope with the different planes of the work.

11th. For the embrasures, after having determined their direction, the intersections of the cheeks and bottom, with the interior and exterior slope of the parapet, and with its slope; also the slope which terminates the interruption of the banquette throughout the extent of the battery. In the case where the platform is formed more than 0^m 4 elevated above the soil, a ramp is constructed with its slope, and the intersections with the slope from the platform are shown.

12th. After the batteries, the slope of the ends of the traverses and of the passages for entry and exit are constructed.

13th. The traverse will be finished by adjusting its different planes with those of the parapet. In the particular case, where it was interfered with to make a passage over the banquette, it is finished by reveting the slope passing by the crest of the banquette of the work.

14th. At the passages of entry and exist from the work, the parapets will be finished by the slope of the revetment, whose intersections with the different planes of the parapets must be determined.

15th. For each squad of workmen, the distance of the salient of the work to the point on which it will be defiladed must be determined.

Memoir.

Memoir.

1st. Object of defilement—which is considered to be dangerous ground, dangerous point, plane of defilement.

2nd. Position of the dangerous point relatively to the work which is to be defiladed. Practical method on the ground. Results to which it leads.

Defilement.

3rd. On the field this method is not always applicable to an isolated work, and never is so to entrenchments of a great development, such as lines, large têtes-de-pont, &c. By what proceeding is it generally expedient to attempt to fulfil in war the indisputable condition of defilement.

4th. Methods of defilement employed. Determination of the different planes of barbettes, of their ramps, of the profiles of the gorge, &c. Construction of embrasures.

5th. Means made use of in practice for determining the distance of the salient of the work to the dangerous point on which it is defiladed.

APPENDIX L—4.

Military Art and Field Fortification.

Recapitulation for the Sub-Lieutenants of Artillery and Engineers.

First Lectures.—Parts of the Course.	No. of Lectures.	Credits for Lectures.			No. of Interrogations.	Observations.
		With application.	Without application.	Total.		
1st Part. Historical notions on the Organization of Armies.	6	–	18	18	1	The number 90 is applied to the interrogations and to the obligations of the notes.
2nd Part. Tactics	3	–	9	9		
3rd „ Castrametation	2	–	6	6		
4th „ Field Fortification	16	24	–	24	2	
5th „ Military Communications	10	15	–	15	1	
6th „ Strategy	6	–	18	18	1	
Totals	43	39	51	90	5	

Recapitulation Table: Artillery and Engineer Students.

Execution of Work.	Number of					Observations.
	Drawings.	Memoirs.	Attendances.		Credits.	
			In the Halls.	Outside.		
Drawings of Military Art,—						
Plate 1. Elements of Lines	1	–	4	–	20	
„ 2. Details of a Field work	1	–	8	–	35	
„ 3. Project of a Road	1	–	8	–	35	
Memoir	–	1	1	–	10	
Plate 4. Military Bridges	1	–	8	–	35	
Memoir	–	1	2	–	20	
Project of Field Fortification,—						
Plate 1. Plan of the whole	1	–	3	–	15	
„ 2. Organization of a work	1	–	8	–	35	
„ 3. Details of Construction	1	–	5	–	20	
Memoir	–	1	3	–	30	
Tracing of Camps	–	–	–	1	5	
Tracing on the ground	–	–	–	2	10	
Memoir	–	1	1	–	10	
Totals	7	4	51	3	280	

Recapitulation of the Credits of Influence.

Lectures	90
Execution of Work	280
Totals	370

Program of Permanent Fortification course.

5.—PROGRAMME OF PERMANENT FORTIFICATION, AND THE ATTACK AND DEFENCE OF PLACES.

The course of instruction in Permanent Fortification and the Attack and Defence of Places, is divided into three parts, viz.:—

Division of the course.

	No. of Lectures given to	
	Artillery.	Engineers.
The first part consists of the study of the Construction of existing Fortifications, and it is common to the two services; it comprises.	10	10
The second part contains the principles of the Art of Fortification, divided into three sections, of which the 1st section relates to Fortification on level ground.	19	19
The second part contains the principles of the Art of Fortification, divided into three sections, of which the 2d section relates to Fortification on hilly ground.	19	26
The second part contains the principles of the Art of Fortification, divided into three sections, of which the 3rd section relates to general questions of Fortifications,	4	5
Third part relates to the Attack and Defence of Places	24	24
Total Number of Lectures	76	84

The first part contains a description of the various works of permanent fortification, their respective uses, and the changes that have been successively made in them, together with a short history of ancient fortification prior to the invention of powder, and the changes introduced consequent on the invention of fire-arms.

A short abstract of the systems of Errard, Beville, Pagan, Vauban, Coehorn, and Cormontaigne.

Permanent Fortification and Attack and Defence of Places.

The first section of the second part describes the principles on which the various parts of a front of fortification on level ground, and according to Cormontaigne's system, are regulated, such as the command, relief, defilement, form, length, and material of which the various parts should be constructed; the modifications required by the absence or presence of water; the changes which are necessary as regards exterior or advanced works, and ending with a comparison of a front of fortification according to Cormontaigne, with a modification of the same system introduced by the French Engineers.

Division of the course.

The second section commences with the principles of defilement and its application under various given circumstances, proceeds with the description of an imaginary work founded on certain given data, and furnishes the data of its proposed construction. It then supplies the theory relating to mines, and their use in the attack, defence, and destruction of places, and points out the particular duties of Engineers in fortified places, and the proper and most efficient manner of carrying them on.

The third section relates to the preparation of projects for the improvement of inefficiently fortified places, and to the utility, particular organization, and proper position of fortified places on a frontier line. It then explains the necessity for military law in providing for the security of fortified places and districts along the frontiers of a State.

The third part describes the various operations connected with the Attack and Defence of a bastionned fortification, commencing with the operations preliminary to the siege and investment of the place, and continuing to describe the several processes to be employed in the attack of the place, with the corresponding efforts that should be made during its defence, and ending with an historical account of certain sieges.

This course requires the practical completion of the following:

Nature of the Work.	Time allowed for its Completion.	Subject of the Work.	Scale.	Observations.	
		1st Part.—On existing Fortifications.			
Single Plate	20 days -	Complete projection of the front of Cormontaigne without counter-guard or cavalier.	$\frac{1}{1000}$	Common to the Students of both Services.	Drawings. Common to Students of both Services.
		Three profiles of the front - -	$\frac{1}{600}$		
		2d Part.—Principles of the Art of Fortification.			
Plate, No. 1	8 „	1st Section: Fortifications on level ground.—Principal graphical constructions of the front on level ground according to particular data given to each Student.	$\frac{1}{1000}$	Ditto.	
Plate, No. 2	28 „	Complete projection of the whole of the visible and underground parts of the same front.	$\frac{1}{1000}$	Ditto.	
		Three profiles of the front - -	$\frac{1}{600}$		
Memoir -	6 „	Description of the principles of the Fortification, with a detailed discussion of the dispositions adopted in the particular case treated by the Students.			
Plate 3 -	20 „	2d Section: Fortification on hilly ground.—Drawing of the ideal fortress and of its Tête-du-pont, with the interior entrenchments, inundation, sluices, and all necessary details to enable a proper comprehension to be had of the action of the water.			
		Drawing complete of one of the fronts of the place and its outworks, described by a particular programme. Defilement of all the works of this front and of the masonry of one of its faces.	$\frac{1}{2000}$		
Memoir -	3 „	On the situation of the fortification; description of the imaginary fortress, and of the management of the water; explanation of the operations of defilement drawn on Plate 3.			
Plate 4, (Artillerie).	10 „	Plan and profile of a full revetment of the escarp with its counterforts.	$\frac{1}{200}$	Special work for the Artillery Students.	Special for Artillery Students.
		Plan, profiles, and elevation of a revetment "en décharge."	$\frac{1}{300}$		

APPENDIX I.—5.

ermanent Fortification and attack and Defence of Places.

	Nature of the Work.	Time allowed for its Completion.	Subject of the Work.	Scale.	Observations.
			Detail of a gallery and small chamber of a mine, of its tamping and mode of firing.	$\frac{1}{50}$	
Drawings. Special for Engineer Students.	Plate 4, (Engineers).	20 days -	Detailed project of one of the parts of the front of fortification defiladed in Plate 3. Plans at different height; disposition of the galleries and small chambers of mines required for blowing up the whole of the ground between two listening galleries.	$\frac{1}{250}$	Special work for the Engineer Students.
	Plate 5 -	10 „	Sections and elevations of the preceding project. Foundations, coping of vaults, dressing of cut stones, &c. Detail of a small gallery and chamber of a mine, comprised in the dispositions of Plate 4. Tamping and mode of firing.	$\frac{1}{125}$	Ditto.
	Avant- -	3 „	Abstractions of measurement of a part of the preceding project.	—	Ditto.
	Plate 6 -	11 „	Study of the alterations in the earth of the same part of the projects, representing the four principal periods of the work, by a plan and section, with an elevation of the 4th period.	$\frac{1}{250}$	Ditto.
	Memoir -	2 „	General theory of the removal of earth. Application to a particular project.	—	Ditto
	Register -	3 „	Register of the removal of earth as represented in Plate 6.		
	Estimate -	1 „	Estimate of the part of the project to which the abstraction of measurements has been applied. 3rd Section: Projection of the improvement of an existing fortified place.		
	Plate 7 -	30 „	Complete projection of the project for improving an existing fortified place.	$\frac{1}{1000}$	
	Plate 8 -	6 „	Details of the most interesting parts of the project, in plans, sections, and elevations.	$\frac{1}{250}$	
	Memoir -	2 „	Marginal notes on the defects presented by the existing system, and on the means employed for correcting them.		
	Calculation -	5 „	Balance of the "deblais" and "remblais" of the project.		
			3rd Part.—Attack and Defence of Places.		
Common to Students of both Services.	Single Plate	30 „	Project of attack of a front of fortification on level ground.	$\frac{1}{2000}$	Common to the Students of the two services.
			Details of the attack.	$\frac{1}{200}$	
	Journal -	4 „	Journal of the siege. Details relating to the composition of the garrison and of the beseiging army; also on the material for the Artillery and Engineers required for the attack and defence. Pen sketch of the most elementary works of attack.		

Recapitulation for Artillery Students.

RECAPITULATION for the ARTILLERY.

1.—Lectures. Parts of the Course.	Number of Lectures.	Credits for the Lectures. With application (a).	Credits for the Lectures. Without application (b).	Credits for the Lectures. Total.	Number of Interrogation.	Observations.
1st Part. Study of existing Fortifications.	10	4.5	21	26	1	(a) The Lectures with application count for 1h 5m. (b) Those without application for 3h.
2d Part. Principles of the Art of Fortification.	—	—	—	—	—	
1st Sect. Fortification on level ground.	19	24.0	9	33	2	
2d Sect. Fortification on hilly ground.	19	19.5	18	38	2	
3d Sect. General questions of Fortification.	4	—	12	12	—	
3rd Part. Attack and Defence of Places.	24	24	24	48	2	
Totals - -	76	72	84	157	7	

2. Execution of Work.	Number of Drawings.	Number of Memoirs.	Number of Various.	Number of Sittings in the Halls of Study.	Credits.	Observations.
1st Part. Front of Cormontaingne -	1	–	–	20	90	
2nd „ Plate 1. Construction of Project on Level Ground.	1	–	–	8	35	
Plate 2. Project on Level Ground.	1	–	–	28	125	
Memoir on ditto - - -	–	1	–	6	55	
Plate 3. Project on Hilly Ground.	1	–	–	20	90	
Memoir on ditto - - -	–	1	–	3	30	
Plate 4. Project of Details, Plan.	1	–	–	20	90	
Plate 5. Project of Section, Plan.	1	–	–	10	45	
Abstraction of Measurements	–	–	1	3	25	
Plate 6. Removal of Earth -	1	–	–	11	50	
Memoir on ditto - - -	–	1	–	2	20	
Register of ditto - - -	–	–	1	3	25	
Estimate of the Project - -	–	–	1	1	10	
Plate 7. Project of Improvements.	1	–	–	30	135	
Plate 8. Details of ditto -	1	–	–	6	25	
Memoir on ditto - - -	–	1	–	2	20	
Balance of Deblais and Remblais.	–	–	1	5	45	
3rd Part. Project of Attack - -	1	–	–	30	135	
Journal of the Siege - -	–	1	–	4	35	
Totals - - -	10	5	4	212	1,085	

RECAPITULATION of the CREDITS OF INFLUENCE—

Lectures - - - - - - - -	165	1,250
Execution of Works - - - - -	1,085	

APPENDIX I.—5.

Permanent Fortification and Attack and Defence of Places.

Recapitulation for Artillery Students.

Recapitulation for the Artillery—*continued.*

2. Studies and Execution of Work.		Number of Drawings.	Number of Memoirs.	Number of Sittings in the Halls of Study.	Credits.	Observations.
1st Part.	Front of Cormontaingne -	1	–	20	90	
2d „	Plate 1. Construction of the Project on Level Ground.	1	–	8	35	
	Plate 2. Project on Level Ground.	1	–	28	125	
	Memoir - - - - -	–	1	6	55	
	Plate 3. Project on Hilly Ground.	1	–	20	90	
	Plate 4. Details of the Project.	1	–	10	45	
	Memoir - - -	–	1	3	30	
3d Part.	Plate. Project of Attack -	1	–	30	135	
	Journal of Attack - -	–	1	4	35	
	Totals - -	6	3	129	640	

Recapitulation of the Credits of Influence.

Lectures - - - - - - - - -	160	800
Studies and Execution of Work - - -	640	

Recapitulation for Engineer Students.

Recapitulation for the Engineers.

1. Lectures.		No. of Lectures.	Credits for Lectures. With application.	Credits for Lectures. Without application.	Credits for Lectures. Total.	No. of Interrogations.	Observations.
1st Part.	Study of existing Fortification.	10	4.5	21	26	1	The number 162 is applicable to the Interrogations.
2d „	Principles of the Art of Fortification.	–	–	–	–	–	
	1st Section. Fortification on Level Ground.	19	24.0	9	33	2	
	2d Section. Fortification on Hilly Ground.	26	36.0	6	42	2	
	3d Section. General Questions on Fortification.	5	1.5	12	13	–	
3d Part.	Attack and Defence of Places	24	24.0	24	48	2	
	Totals - -	84	90.0	72	162	7	

6.—PROGRAMME OF THE COURSE OF TOPOGRAPHY.

Topography.

The course of topography comprehends two parts:—

The first relates to the art of topographical drawing, and the second to the art of making topographical surveys. Both parts are carried on *pari passu;* but as the order in which the different branches of the instruction can be given depends very much on the other works carried on in the School, it will be more convenient to give the program for each separately.

1st Part.—Instruction in Topographical Drawing.

The instruction in topographical drawing comprehends lectures and exercises in graphical representation. It is based on a complete exposition of the conventional principles of this species of drawing, and it is illustrated by engraved examples of the characteristics adopted for the representation of the various details.

1st Section.—Lectures.

The lectures have for their object the explanation of the general principles of the instruction in topographical drawing, and the geometrical conditions which should regulate the shading of maps and their reduction. They immediately precede the exercise to which they relate.

Lectures.

Lecture 1 relates to small maps, copies, and reductions of these; and it explains the object of topographical maps, the various kinds and the different scales generally used. The manner in which the form of the ground is represented by equi-distant contour or level lines is also explained, and mention is made of the conventional tints used, and the species of writing and value of the scale employed.

Lecture 2 & 3 relate to the execution of shaded plans by the brush and the pen, under different circumstances of light and shade.

Lecture 4 explain the different methods for reducing topographical maps, also the description, mode of using, and verification of pentagraphs.

2d Section.—Exercises.

Exercises.

These exercises are intended to teach the students the conventional signs used in topographical drawing, and to give them facilities with the pencil and brush for producing shaded maps, and in reducing them from one scale to another.

2d Part.—Instruction in Topographical Surveying.

Instruction.

This instruction comprises:—

1st. Lectures given in amphitheatre.
2d. Practical lectures or exercises.
3d. The execution of topographical surveys.

1st Section.—Oral Lectures.

These lectures are divided in two classes, which comprehend:—

1st. Those relating to the description of the instruments, and of the methods used in topography.
2d. Those which have reference to the manner in which the students should proceed in the execution of the work, and principally of surveys of limited extent.

Oral Lectures.

Eight lectures are devoted to the description of the various instruments, the method of adjusting their errors, and the manner of using them, as well as to the different ways of proceeding in topography; touching also on the various modes of measuring distances, with descriptions of the compass, plane table, and instruments used for levelling, and on the taking observations for and preparation of sections, and the orientation of maps.

Four preparatory lectures are given, showing the manner in which the students should proceed when on the ground to make a survey of small extent.

Two lectures relate to the methods that should be employed in making a survey of considerable extent, and on the appropriate scales.

Two lectures on military reconnaissance plans; instruments and scales employed.

Two preparatory lectures relate to the execution of a reconnaissance plan, in which the operations of a sham siege are intended to be recorded.

2d Section.—Practical Lectures or Exercises.

Practical Lectures.

The object of these lectures, which take place on the glacis of the fortification, is to show the students the practical modes of using the instruments, and the precautions which must be taken, together with the most elementary proceedings in topography. They are given to ten or twelve students at the same time, and the Professor is assisted by an officer of the staff. Each lecture lasts two and a half hours.

3d Section.—On the Execution of Topographical Surveys.

Out-of-door Work.

The object is to familiarise the students with the use of the principal instruments and the principal operations, and they comprehend out-of-door work, of which the results are sketches, registers, and minutes made in pencil, and in the construction of plans, and inking in of the minutes in the Halls of Study.

The out-of-door work is performed under the superintendence of officers of the staff, who assist the students in their work. The construction of the plans is not commenced until the pencil minutes have been examined by the Professor.

APPENNDIX I.—6. Topography.

These exercises comprise :—

1st & 2d. Construction of plans by the aid of the compass.
3d. The plan of a fortification made with the plane table.
4th. The determination of the variation of the compass.
5th. The execution of a second survey by the aid of the compass.
6th. „ „ rapid survey by pacing the distances.
7th. „ „ reconnaissance survey
8th. „ „ an itinerary and reconnaissance sketch.
9th. The preparation of a plan on which the whole of the operations of a sham siege may be laid down, as the works of attack and defence proceed.

Recapitulation for Students of both Services.

RECAPITULATION for the ARTILLERY and ENGINEERS.

Lectures.	Number of Lectures.	Credits for Lectures. With Application.	Credits for Lectures. Without Application.	Credits for Lectures. Total.	Number of Interrogations.	Observations.
1st Part:—						* The credit is diminished here and carried forward to the exercises, which serve for the interrogations of many lectures. These lectures have therefore really three series of interrogations.
Topographical Drawing	4	6	—	36	2	
Art of Surveying—						
On the Instruments and Topographical processes	8	12	—			
On Surveys of considerable magnitude	2	—	6			
On Reconnaissance Plans	2	1.5	3			
Preparatory to Out-of-door Work	5	7.5				
Total	21	27	9	30*	2	

RECAPITULATION—*continued.*

Execution of Work.	Number of: Drawings.	Memoirs.	Various.	Attendances: In the halls.	Attendances: Out of the halls.	Attendances: Out of doors.	Credits.	Observations.
1st Part:—								* The description Itinerary is reckoned with the simulated siege operations.
Topographical Drawing:								
Conventional Tints	1	—	—	3	—	—	10	† This number is formed with 5 taken from it for the credit of the interrogations, because the exercises serve for the interrogations of several lectures.
Study of Maps	4	—	—	26	—	—	120	
Reduction	1	—	—	2	—	—	10	
Construction of a Triangulation with the Compass	1	—	—	3	—	—	15	
1st Survey with the Compass:								
Out-of-door work	—	—	1	—	—	6	50	
Laying down	1	—	—	4	—	—	20	
Survey of Fortifications with the Plane table:								
Out-of-door work	1	—	1	—	—	10	80	
Laying down		1	—	4	—	—	25	
Determination of the Variation of the Compass	1	—	—	1	1h	—	5	
2nd Survey with the Compass:								
Out-of-door work	1	—	1	—	—	8	65	
Laying down	1	—	—	2	—	—	10	
Rapid Survey:								
Out-of-door work	1	—	1	—	—	6	50	
Laying down		1	—	4	—	—	25	
Reconnaissance Survey:								
Out-of-door work	1	—	1	—	—	4	30	
Laying down		1	—	3	—	—	20	
Itinerary and Reconnaissance*	1	—	—	—	—	1	10	
Topographical operations relative to a sham siege	—	For a Memoir.						
Topographical exercises, each of 2½ hours' duration	—	—	—	—	6	—	20†	
Total	15	3	5	52	7	35	565	

RECAPITULATION of the CREDITS OF INFLUENCE.

Lectures	30	595
Execution of work	566	

7.—PROGRAMME OF THE COURSE OF GEODESY AND DIALLING.

Geodesy and Dialling.

This course is divided into two parts—the one part special for the Engineers, and the other common to the artillery and engineers.

The first comprises :—

1st. The study of the execution of a triangulation of some extent, and of its connexion with the general triangulation of France, executed under the superintendence of the Dépôt de la Guerre, and

2d. Levelling with the barometer.

Division of the Course.

The second contains :—

1st. The study of reflecting instruments.

2d. The principles of dialling.

Each of these parts comprehend :—

1st. Lectures given in the amphitheatre.

2d. Practical lectures or exercises.

3d. An application.

1st Part.—Special for Engineers.

1st Section—Lectures.

These Lectures include:—

1st. A description of the principal geodesical instruments.

2d. The establishment of the triangulation.

3d. The survey and the calculations connected with it.

4th. The orientation of the triangulation.

5th. The calculation of the co-ordinates of the points and their construction from the minutes of the survey.

6th. Geodesical and barometrical levelling.

Special for the Engineer Students.

The first lecture is devoted to the explanation of the different kind of signals used under various circumstances; on the method of measuring bases and angles, and the principles on which these operations are performed; and concluding with the description and mode of using certain instruments for measuring angles.

The second lecture continues and enlarges on the subject of the measurement of angles, horizontal and vertical, with different kinds of instruments.

The third lecture relates to the corrections and reductions which must be made to observed angles, such as the correction for the eccentricity of the instruments, to the reduction of the angles to the horizon, and to the centre of the station, and also on the adjustments of the instruments, or the application of corrections for certain errors.

The fourth lecture discusses the calculation of the triangles and their errors, and points out the best organization that can be given to the triangulation, and the exactitude which can be expected from it.

The fifth lecture also relates to the calculation and the development of the triangulation, and explains the nature of the geodesical operations for the map of France.

The sixth lecture explains the manner of observing for, and determination of the azimuthal bearing, for the orientation of the triangulation.

The seventh lecture has reference to the convergence of meridians, calculation of rectangular co-ordinates, sundry problems, and geodesical levelling.

The eighth lecture shows in what manner the barometer is made use of for the determination of differences of altitude, the nature of the corrections to be applied to the instrument, and the degree of exactitude to be found in the results of this process.

The ninth lecture points out the order in which geodesical calculations should be performed and the verifications which should be exacted.

The 2d Section contains five lectures or exercises, and they have for their object to familiarise the students with the use of the various kinds of instruments employed in carrying on the operations which have been shortly described in the first section.

The 3d Section relates to the practical application of the preceding principles, and mostly consists of geodesical applications.

2d Part.—Common to the Artillery and Engineers.

Common to Students of both Services.

The 1st Section consists of lectures given in the amphitheatre, and relates to reflecting instruments, such as the sextant, reflecting circle, and the method of using them, and also on the principles of dialling, and its connexion with various problems in astronomy; describes also the different kind of dials.

2d Section.—Practical Exercises.

Practical Exercises.

In which the students are called upon, in the presence of the Professor, to adjust the sextant, and to use it in connexion with an artificial horizon for the measurement of the angle between any two objects of the altitude of these objects above the horizon, and also the same altitude.

APPENDIX I.—7.

Geodesy and Dialling.

3d Section contains the practical application of the principles enunciated in the preceding sections, in the preparation by the students of two drawings, in which they will exhibit the graphical representation of the hour in terms of the altitude of the sun previously observed, and show the various constructions of a sun dial, according to the specified conditions based on the observation of the hour angle.

Recapitulation for Engineer Students.

RECAPITULATION for the ENGINEERS.

Lectures.	No. of Lectures.	Credits for Lectures.			No. of Interrogations.
		With application.	Without application.	Total.	
1st Part :—Geodesy:					
Lectures with application -	4	6	–	21	1
„ without application -	5	–	15		
2d Part :					
Reflecting Instruments - -	1	1.5	–	4.5	1
Dialling - - - - -	2	3			
Total - - -	12	10.5	15	25.5	2

Execution of Work.	Number of					Credits.
	Drawings.	Memoirs.	Etats Divers.	Attendance.		
				In the Halls.	Out of the Halls.	
1st Part :						
Geodesical calculations - -	–	–	1	4	–	20
Exercises of $2\frac{1}{2}$ hours - -	–	–	1	–	5	10
2d Part :						
Drawings of Dialling - -	2	–	–	4	–	20
Exercises of $2\frac{1}{2}$ hours - -	–	–	–	–	1	5
Total - - -	2	–	2	8	6	55

RECAPITULATION of the CREDITS OF IMPORTANCE.

Lectures - - - - -	25	80
Execution of Work - - -	55	

Recapitulation for Artillery Students.

RECAPITULATION for the ARTILLERY.

Lectures.	No. of Lectures.	Credits for Lectures.			No. of Interrogations.
		With application.	Without application.	Total.	
Reflecting Instruments - - -	1	4.5	–	5	1
Dialling - - - - -	2				
Total - - -	3	4.5	–	5	1

Execution of Works.	Number of				Credits.
	Drawings.	Days		Memoirs.	
		In the Halls.	Out of the Halls.		
Drawings of Dialling - - -	2	4	–	–	20
Exercises of $2\frac{1}{2}$ hours - - -	–	–	1	–	5
Total - - -	2	4	1	–	25

RECAPITULATION of the CREDITS OF IMPORTANCE.

Lectures - - - -	5	30
Execution of Works - -	25	

8.—PROGRAMME OF THE COURSE OF SCIENCES APPLIED TO THE MILITARY ARTS.

Sciences applied to the Military Arts.

		Lectures.
1st. Part.—	Geology	12
2d „	On the metallurgy of iron, on working in iron	6
3d „	Applications of the working in iron	3
4th „	On the manufacture of small arms	4
5th „	„ „ „ of ordnance	5
6th „	„ „ „ of powder	5
7th „	On pyrotechny	2
	Total	37

First Part.—Geology.

Geology.

Lecture 1.—Preliminary notions. Definition of geology expressed from its applications. Division in four sections:—1st. Mineralogy. 2d. Paleontology. 3d. Geognosy. 4th. Geogeny. (Only the three first are here treated of.)

First Section.—Mineralogy. Generalities. Distinctive characters of minerals. Fundamental principle of a mineralogical classification. Minerals are distinguished as having characters either exterior, crystalline, chemical or physical; classification of minerals.

Lecture 2.—First class: Simple bodies forming one of the essential principles of minerals. Genus silica, quartz, sulphur. Second class: Alkali and alkaline salts, potass, soda, &c. Third class: Alkaline earths and earths. Genus lime. Fourth class: Metals. Iron of various kinds; copper, lead, tin, zinc.

Lecture 3.—Fifth class: Silicates of various kinds. Sixth class: Combustibles, minerals.

Lecture 4.—Description of various rocks. Classification of rocks.

Lecture 5.—Use of rock and stone in the arts, and particularly in the art of construction.

Lecture 6.—On the calcination of calcareous stones, lime-kilns.

Lecture 7.—Manufacture of artificial hydraulic lime, manufacture of bricks, stucco, or cements.

Lecture 8.—Second section: Paleontology. General division established in zoology and botany. General notions relating to the different kinds of animals and vegetables, of which the remains are found in various geological formations. Third section: Geognosy. Lectures 9, 10, 11, 12, occupied with the explanation of the various formations.

Second Part.—On Working in Iron.

Working in Iron.

Lecture 13.—Preliminary notions. Definitions and general considerations. Characteristics of iron, steel, cast iron, &c.

Lecture 14.—On iron ore and the various kinds of fluxes.

Lecture 15.—On combustibles. Vegetable combustibles, mineral combustibles.

Lecture 16.—Manufacture of cast-iron. High furnaces, different modes of proceeding with vegetable and mineral combustibles.

Lecture 17.—Manufacture of iron and steel and the different kinds of iron.

Third Part.—Application of the Working of Iron.

Lecture 19.—Making of projectiles, carriages for guns and mortars, axle-trees and anchors. Use of cast-iron for artillery. General notions in moulding. Use of wrought-iron and steel. Materials first made use of for the making of projectiles, and on the casting of cannon balls, &c.

Lecture 20.—On the manufacture of hollow projectiles and the carriages for guns and mortars.

Lecture 21.—On the manufacture of axles and anchors.

Fourth Part.—On the Manufacture of Small Arms.

Manufacture of Small Arms.

Lecture 22.—Preliminary considerations. Assay of metals. Fire-arms, manufacture of gun-barrels, describing the various details.

Lecture 23.—Bayonets, locks, &c.

Lecture 24.—On the making of stocks. Finishing. Rifling small arms.

Lecture 25.—Manufacture of sabres, swords, lances, hatchets cuirasses, and on the preservation, maintenance, and repair of arms.

Fifth Part.—On the Manufacture of Ordnance.

Manufacture of Cannon

Lecture 26.—Preliminary notions. Metals proper for the manufacture of ordnance. Composition and properties of gun-metal. Wrought and cast iron ordnance. Moulding generally. Moulding of cannons.

Lecture 27.—Moulding of howitzers. Foundries. Fusion of the metals.

Lectures 28, 29.—Boring. Turning. Carving. Turning of the trunnions, &c. manufacture and reception of bushes. Insertion and replacement of bushes.

Lecture 30.—Last operations. Proofs and reception of cannon. Chemical operations. Assay and analysis of the metals employed in the casting of gun-metal; proportion of the several ingredients.

APPENDIX I.—8.

Sixth Part.—On the Manufacture of Powder.

Sciences applied to the Military Arts.

Manufacture of Gunpowder.

Lecture 31.—General notions. Various kinds of powder, &c. On saltpetre and sulphur.

Lecture 32.—Charcoal; wood employed; various kinds of charcoal; proceeding followed in making powder in various ways by the pestle.

Lecture 33.—Manufacture by mills, &c.

Lecture 34.—Influence of the proportion of the several ingredients, and of the manner of making it on its various properties. Preservation, inflammation, and combustion.

Lecture 35.—Proofs and reception of powder. Proof of its projectile force. Mortar proof, and various kinds of other proofs to which it is subject. Reception and analysis of powder.

Seventh Part. Pyrotechny.

Pyrotechny.

Lecture 36.—Preliminary ideas. Objects of the course. Precautions that should be adopted to prevent accident. Mixture of the materials. Manufacture of leaden balls of various kinds. Caps. Fireworks for warlike purposes, used for setting buildings, &c. on fire. Firing cannon and exploding mines.

Lecture 37.—Fireworks employed under various circumstances in war. Signal rockets. For illuminating or setting on fire. For explosions. Petards. On ordinary fireworks.

Works of Application.

Works of Application.—The works of application which are connected with the course of science applied to the military arts are as follows:—

1st. Study of samples of mineralogical specimens.
2d. Study of geological maps to be followed by a memoir.
3d. Memoirs on, 1st, iron and its applications, 2d, Manufacture of cannon. 3d. Manufacture of small arms and powder.
4th. Out-of-door geological excursions to be followed by memoirs.
5th. Manipulations relative to moulding in earth or sand.
6th. Chemical manipulations.
7th. Pyrotechnic manipulations.

1st.—Study of Samples of Mineralogical Specimens.

Mineralogical Specimens.

This study has for its object the determination of the kind of minerals described in the course. It is made in sections of ten or twelve Sub-Lieutenants and by attendances of one hour, each Sub-Lieutenant being called upon to reply at least three times.

2d.—Study of Geological Maps, followed by a Memoir.

Geological Map.

The study of geological maps will consist in indicating, by conventional colours, the different geological formations of a lithographical map, and to make a section in a particular direction. The map will be the same for all, and it will be conceived so as to correspond with the geological formation of France, but the sections will differ for each student.

An explanatory memoir will have for its object to call the attention of the Sub-Lieutenants to the most salient facts which will be placed in relief by this study.

One attendance in the halls of study will be devoted to this work.

3d.—Three Memoirs.

Memoirs.

Three memoirs on different parts of the course, other than the geological, will be made immediately after the interrogations relative to each section. Particular data will be furnished to each Sub-Lieutenant. Three attendances in the halls of study will be allowed for these memoirs.

4th.—Geological Excursions.

Geological Excursions.

Three geological excursions will be made in the environs of Metz by groups of ten or twelve Sub-Lieutenants under the direction of the Professor, and at the period of the out-of-door work, so as not to interfere with the current work in the halls. The first excursion will have for its object the study of the lias and lower oolite, met with in the vicinity of Metz. If the time will admit of it, a reconnaissance will be made to the great oolite at Taumont or at Amanvillers.

The second excursion will be made in the direction of Gorze for the study of the lower oolitic formation and to trace it up to Bradford clay, where an important fault occurs in this direction near to Metz. The study of this fault will be the great object of this excursion.

The third excursion will be made in the direction of Forbach, meeting with the lias, chalk-coloured freestone, &c.

Three entire days will be devoted to these excursions, and each Sub-Lieutenant will enter his observations in a note book, and make a certain number of sections, and report the results of these excursions in three memoirs in a specified time.

5th.—Manipulations relative to Moulding in Earth or Sand.

Moulding in Earth and sand.

These mouldings of projectiles will be made by sections of ten or twelve Sub-Lieutenants, two attendances of three hours each being devoted to them, one for ordinary and the other for hollow projectiles.

The manipulations for the moulding of cannon will be executed by the Professor.

All the Sub-Lieutenants will be successively called by sections a certain number of times, in order that they may be enabled to render an account of the different states of advancement of the work.

Program of practical instruction for the casting of projectiles.

1st attendance. Making shot, &c.

2d attendance. Making hollow projectiles.

Program of the moulds to be executed by the Professor.

Manufacture of cannon; moulding in earth and the various processes to be carried on.

6th.—Chemical Manipulations.

Chemical Manipulations.

The chemical manipulations are made by sections of ten or twelve Sub-Lieutenants. Nine attendances of three hours each are employed.

1st. To the determination of the specific gravity and real density of gunpowder and to its analysis.

2d. To two other analyses of gun-metal, iron-ore, &c.

Recapitulation for Students of both Services.

RECAPITULATION for the ARTILLERY and ENGINEERS.

Lectures.—Parts of the Course.	No. of Lectures.	Credits for Lectures. With application, 1h. 5m.	Credits for Lectures. Without application, 3h. 0m.	Total Credits.	No. of Interrogations.	Observations.
1st Part, Geology	12	15	6	20	2	The first series of interrogations relates to mineralogy.
2d „ on working in iron	6	–	18	20	1	
3d „ Applications of working in Iron	3	15	6	10		The second to geognosy.
4th „ Manufacture of small arms	4	–	12	10	1	
5th „ „ Cannon	5	–	15	15	1	
6th „ „ Powder	5	–	15	15	1	
7th „ Pyrotechny	2	3	–	5		
	37	19.50	72	95	6	

Works of Application.	Number of Studies.	Sketches.	Memoirs.	Exercises.	Manipulations.	Attendances in the Halls 4h. 5m.	Attendances out of doors 6 hours.	Attendances at the Laboratory. 1h to 2h	Attendances at the Laboratory. of 3h	Attendance at the School of Pyrotechny of 3h.	Credits.	Observations.
Study of Mineralogical Specimens	3	–	–	–	–	–	–	3	–	–	5	
Study of Geological Map, followed by a Memoir												
Map	–	1	–	–	–	1	–	–	–	–	5	
Memoir	–	–	1	–	–	–	–	–	1	–	10	
Memoirs on the Metallurgy of Iron, and its—												
1st, Application	–	–	1	–	–	1	–	–	–	–	10	
2d, Manufacture of Cannon	–	–	1	–	–	1	–	–	–	–	10	
3d, Ditto small arms or powder	–	–	1	–	–	1	–	–	–	–	10	
Geological Excursions, followed by Memoirs:												
Excursions	–	–	–	3	–	–	3	–	–	–	20	
Memoirs	–	–	3	–	–	–	–	–	–	–	20	
Manipulations in Moulding	–	–	–	–	2	–	–	–	2	–	5	
„ „ Chemistry	–	–	–	–	9	–	–	–	9	–	25	
„ „ Pyrotechny	–	–	–	–	5	–	–	–	–	5	15	
Total	3	1	7	3	16	4	3	3	12	5	135	

RECAPITULATION of the CREDITS OF INFLUENCE.

Lectures	95
Works of Application	135
	230

7th.—Manipulations of Pyrotechny.

Manipulations in Pyrotechny.

The manipulations in pyrotechny will be made by the whole division, divided into three brigades. Each brigade will be assembled in one of the halls at the School of Pyrotechny, and will execute the different manipulations indicated in the following program, under the direction of the Professor, and with the assistance of the master artificers of the School of Pyrotechny. Five attendances of three hours will be employed at these manipulations.

APPENDIX I.—8.

PROGRAMME OF THE PRACTICAL INSTRUCTIONS ON MUNITIONS AND FIREWORKS.

Practical Instructions in Pyrotechny.

1st Attendance. Munitions for small arms.

Infantry Cartridges { Construction of bullets. „ of pouches and caps. „ of cartridges.

Cartridges with oblong bullets.

2d Attendance. Ammunition for field guns.

Construction and filling of pouches, packing in wood, &c.

3d Attendance. Ammunition for siege artillery, &c.

Construction and filling of cartridges, &c.

Charging hollow projectiles.

4th Attendance. Fireworks for war purposes.

Construction of matches, quick matches, tubes, fusees for shells and grenades.

Construction of signal rockets.

5th Attendance. Carriage of field ammunition.

Loading and unloading field ammunition chests for cannons, howitzers, and infantry waggons.

Construction of ornamental lances and Roman candles.

9.—PROGRAMME OF THE COURSE OF APPLIED MECHANICS.

First Section.—General Principles.

Applied Mechanics.

Lectures 1 and 2.—Short account of the general principles which serve as a base for the application of mechanics to machines, under the compound ratio of their establishment and of the calculation of their effects.

Lecture 3.—General composition of a factory; power, recipient, transmission of movement, tools. General method of calculating the effect of forces in a complete factory.

General Principles.

Lectures 4, 5, and 6.—Theoretical rules and the results of experiments concerning the flow of liquids. (Particular reference is made to the principles which relate to the large orifices of machines moved by water.)

Lecture 7.—Gauging of the volumes and valuation of the dynamical power of watercourses which feed machines.

Second Section.—Motor Machines.

Motive Powers.

Lecture 8.—Theory of the effect of water on hydraulic wheels. Determination of the elements of the calculation.

Lectures 9 to 13.—Application of the general theories to the principal hydraulic recipients. Conditions of the maximum, relative to the useful effect of each kind. Results of experiments, &c. (With reference to turbines, those which are most generally employed in the artillery workshops must be adverted to).

Lecture 14.—Comparative abstract of the usual properties of various hydraulic "recepteurs." Operations that must be carried on in order to arrive at their results and to their reception in manufactories.

Lecture 15.—Physical ideas relative to the use of the vapour of water as a motive power. Theoretical bases of the calculation of the effects of steam engines. Force exerted by the compression and expansion of elastic fluids.

Lecture 16 to 18.—Practical notions and results of experiments relating to the effects and to the usual properties of the principal systems of steam engines in use, as to the employment, reception, and maintenance in workshops.

Third Section.—Resistance of Materials.

Resistance of Materials.

Lecture 19.—Resistance to compression; 1st, by gradual pressure; 2d, by shock. Results of experience. Application to wooden and cast-iron supports, and to the foundations of machines. Stocks of hammers.

Lecture 20.—Resistance to traction. Application to the shank of a piston, to bolts, chains, cordage, and leather straps. Resistance to flexure. Practical formulæ for calculating the transverse dimensions of the wooden or cast-iron arms of hydraulic wheels, of the catches or sails.

Lecture 21.—Continuation of the resistance to flexure. Practical formula for calculating the dimensions of the several parts of such machines. Cranks, winches, and handles in wood or in metal.

Lecture 21.—Resistance to torsion. Practical formulas. Results of experiments relative to the resistance of wood and metals to boring and turning. Resistance of cast-iron plates to clipping.

Fourth Section.—Working Machines.

Machines.

Lectures 23 and 24.—Of blowing machines. General expression of their useful effect. Conditions of the maximum effect. Ventilators; their use in workshops and galleries of mines. Practical bases of their construction. Blowing machines with a piston. Description. Calculation of the effects and results of experiment.

Applied Mechanics.

Letcures 25 and 26.—Description and properties of alternative and circular sawing machines. Practical rules for their establishment. Results of experiments concerning the motive power they require, the useful effect obtained, and the resistance of various kinds of wood to the action of the tool. Results of observation relative to the work in shops by hand saws.

Lectures 27 and 28.—Machines which act by shocks. Practical formula for the calculation of the loss of acting force in the shock. Description and usual properties of various kinds of hammers employed in workshops. Results of experiments proper for serving as the base for the establishment of lever hammers and pestles in powder manufacturies. Results of calculation and observation relative to hammers and pestles moved directly or by the transmission of a movement by steam.

Lecture 29.—Grindstones for powder manufacturies. Rapidity suitable to the different parts of the work. Means of obtaining it. Calculation of the necessary motive power Sharpening grindstones for the manufacture of arms. Ventilation.

Lecture 30.—Lathes and drilling bits. Description. Rapidity of movement and form. of the tools, according to the nature of the matter and kind of work. Results of experiments concerning the motive force required, and its relation to the useful effect obtained. Composition of a workshop of turning lathes for an arsenal of artillery.

Machines.

Lecture 31.—Boring. Machines for cutting and boring. The form of the tool and the rapidity of its action must depend on the nature of the material and the kind of work. Results of experience concerning the motive power required, and its relation to the useful effect obtained, principally for the boring machines of the manufactories of arms and of foundries. Boring machines, disposal of them in an arsenal.

Lecture 32.—Flatteners.—Machines for centering, for making screw holes. Descriptions. Different rapidity of the work, dependent on its nature and that of the material. Results of experiments concerning the amount of the motive power and its relation to the useful effect obtained.

Fifth Section.—Lectures Preparatory to the Works of Application.

Lecture 33.—Proceeding to be followed in the preparation of the sketches of a machine. Observations on the effects of machines, their duration, original cost, and cost of maintenance, mode of making, &c. Indications of the difficulties which are met with, and means which should be employed.

Special for the Artillery Students.

Lecture 34.—Project of a factory (Specially for the sub-lieutenants of artillery.) Legal conditions respecting the erection of factories. General mode of proceeding with the project. Choice of motor machines dependent on local circumstances and the nature of the work to be performed.

Lecture 35. (Special for the sub-lieutenants of artillery.) Determination of the effects supported by the pieces, whose dimensions should be calculated in applying the practical formula of the resistance of materials. Selection of materials.

Lecture 36. (Special for the sub-lieutenants of artillery.) Principal assemblages of various pieces of machines. Building, foundations, supports of trunnions and pivots.

Section II.—Works of Application.

Survey of Workshops.

Works of Application.

This survey of workshops comprehends :—

1st. Figured sketches and observations made on the ground.

2d. Drawing of the whole and of details shaded.

3d. A memoir containing an accurate description of the machines and workshops, the calculation of the dynamical effect, the exposition of the mode of fabrication, and, in general, the results and consequences of the observations made on the spot. It must be executed by each, conformably with the particular program, and to the instruction which will be given to him. He is allowed for this work thirty-four days, divided as follows :—

Figured sketches and observations,	8
Shaded drawings,	22
Memoir,	4
Total,	34

Project of Machines.

Project of Machines.

This work, executed immediately following the preceding by the sub-lieutenants of artillery only, has exclusively for its object the establishment of a workshop for the service of the artillery, comprehending the driving machines and the principal operators ; or, if there be time, the improvement of the workshops of the same arm, described in the preceding work. This project must be executed conformably to the particular program given to each sub-lieutenant. It comprehends, 1, sheet of drawings, 2, a memoir. Twenty-six days are allowed for this work :

Special for the Artillery Students.

Calculation and drawing,	20
Memoir,	6
	26

APPENDIX I.—9.

Applied Mechanics.

RECAPITULATION.

Recapitulation.

Oral Instruction—Parts of the Course.	Artillery. No. of Lectures.	Artillery. Credits for Lectures. With application.	Artillery. Credits for Lectures. Without application.	Artillery. Total Credits.	Artillery. No. of Interrogations.	Engineers. No. of Lectures.	Engineers. Credits for Lectures. With application.	Engineers. Credits for Lectures. Without application.	Engineers. Total Credits.	Engineers. No. of Interrogations.
1st Section—General Principles - -	7	6	9	15	1	7	6	9	15	1
2d „ Driving Machines - -	11	12	9	21	1	11	12	9	21	1
3d „ Resistance of materials -	4	5	3	8	–	4	5	3	8	–
4th „ Working Machines -	10	15	–	15	1	10	15	–	15	1
5th „ Lectures preparatory to the works of application	4	6	–	6	–	1	1·50	–	1·50	–
Total - -	36	44	21	65	3	33	39·50	21	60·50	3

Works of Application.	Artillery. Number of Sheets of drawings.	Artillery. Number of Memoirs.	Artillery. Number of Attendances. In the Halls.	Artillery. Number of Attendances. Out-of-doors.	Artillery. Credits.	Engineers. Number of Sheets of drawings.	Engineers. Number of Memoirs.	Engineers. Number of Attendances. In the Halls.	Engineers. Number of Attendances. Out of doors.	Engineers. Credits.
Survey of Workshops:										
Figured sketches and observations -	1 note book.	–	–	8	65	1 note book.	–	–	8	65
Shaded drawings - - - - -	1	–	22	–	100	1	–	22	–	100
Memoir - - - - - -	–	1	4	–	40	–	1	4	–	40
Project of Machines:										
Calculations and drawings - -	1	–	20	–	90	–	–	–	–	–
Preparation of memoir - - -	–	1	6	–	60	–	–	–	–	–
Total - -	1 note book 2 sheets	2	52	8	355	1 note book 2 sheets	1	26	8	205

RECAPITULATION.

	Artillery.	Engineers.
Credits for lectures assigned to the interrogations -	65	60
Credits for works of application - - -	355	205
	420	265

10.—PROGRAMME OF THE COURSE ON CONSTRUCTION.

Construction.

The course on construction is divided into four parts.

The first part relates to the elements of masonry and the principles which should regulate the form, dimensions, and the construction of walls, and the different parts of buildings; it contains eighteen lectures.

The second part is devoted to the architecture of military buildings—twelve lectures.

Division of Course.

The third part supplies the theory of the stability of construction, and is divided into—

1st section, relating to the resistance of materials—six lectures.

2d „ to the stability of walls of revetments and arches—nine lectures.

The fourth part applies to constructions in water—twenty lectures.

Nearly the same for both Services.

The course is very nearly the same for the Artillery as for the Engineers.

ELEMENTS OF MASONRY, &c.

Lectures 1, 2, and 3.—Relate to the elements of which masonry is composed, such as the different kinds of stones, usual dimensions, manner in which good stone may be known; bricks, lime, cement, sand, mortar, stucco, mastic plaster, asphalte, &c., and to the general considerations relating to foundations, and the different kinds of walls under various circumstances.

Masonry.

Lecture 4.—Treats of sustaining walls and the probable effects of the pressure of the earth. Of the conditions which must be fulfilled to ensure stability. Various formulæ on the subject. Details of construction and on the proper material to be used.

Lecture 5.—Refers to the manner of facing masonry. Openings in walls, windows. Partition-walls.

Construction.

Lecture 6.—On cylindrical arches, vaults, keystones. Formulæ for the calculation of the thickness of piers of an arch or vault. Construction and use of tables for the calculation of the thickness. Construction of arches and vaults in different materials.

Lecture 7.—Arches continued, flat arches, plate bands, &c.

Lecture 8.—On the woods used in construction. On the influence of the soil on its quality. Characteristics of good wood. Preservation of wood. Proper wood for constructions.

Lecture 9.—Flooring. Beams. Girders. Joists. Ceilings.

Lecture 10.—Staircases, conditions respecting. Construction of different kinds of staircases, part of masonry, wood, &c., steps. Construction of landing places, &c.

Lectures 11 and 12.—Roofs in carpentry. Conditions which should be satisfied. Composition of the roof of a building. On the different kinds of roofs.

Lecture 13.—On the different ways of joining pieces of wood or timber together.

Masonry.

Lecture 14.—On permanent kinds of roofing. Conditions which should be fulfilled by good roofing. Composition of roofing. Tiles, lathing, cut slates, ridge tiles, hollow tiles, Dutch tiles. On slate roofing. Metallic roofing. Metal mostly used. Precautions to be taken with reference to all metal roofing.

Lecture 15.—Details relating to inhabited buildings. Cellars. Privies. Drainage. Chimnies; cause of their smoking. Most favourable forms of the flues, pipes. Bakehouse, hearth.

Lecture 16.—On joinery and locksmiths' work. Flooring of different kinds. Doors. Camp-beds. Racks and mangers in stables. Shutters.

Lecture 17.—Apparatus for heating and for cooking food. Hearth, ash-pan. Grate-flues. Amount of surface to be given to heating apparatus. Furnace of kitchens in barracks. Summary notions on the heating and ventilating of buildings. Calorifères with hot air, steam, and hot water.

Lecture 18.—Plan of a building. Projections adopted for the representation of a building. Plans, sections and elevations. Order in which the measurements should be made, and the sketch prepared. Height at which the horizontal plane of projection should pass, &c.

Second Part.—Architecture of Military Buildings.

Military Buildings.

Lecture 1.—Decoration, without making use of the orders of architecture. Principal conditions relating to decoration. Symmetry, regularity, simplicity, unity, and apparent solidity. Proper character. Proportions of the façades. Height of the stories. Basements. Horizontal chains or fillets. Vertical chains and pilasters. Proportions of the doors and windows. Arcades and arched windows. Cornices, pediments.

Lecture 2.—Distribution of buildings. Considerations that should have weight in the distribution. Number composing the edifice. Circumstances that guide in the disposal of masses. Conditions that should be satisfied in placing a building. Locality and suitable dimensions. Relations that should exist between them. Interior and exterior communications. Stories on the same floor. Position of the large rooms. Separation of the rooms. Position and arrangement of staircases. Verification of stability.

Lecture 3.—Conditions to be fulfilled in the distribution of the principal military establishments. Arsenals. Polygons for drill. Military establishments to the School of Bridges.

Lecture 4.—Foundries. Manufacture of arms.

Lecture 5.—Refining saltpetre. Powder. Powder magazines. Details relative to the construction of lightning conductors.

Lecture 6.—Infantry and cavalry barracks.

Lecture 7.—Hospitals. Military prisons and penitentiaries.

Lecture 8.—Storehouse for corn. Store-pits. Storehouse for fodder. Preserving houses.

Lecture 9.—Cisterns. Filtration.

Lecture 10.—Military tribunals. Guard-house. Gates of cities. Hotels and dwelling houses. Officers' quarters.

Lecture 11.—Preparatory to the execution of a project for a building. Method of proceeding. Composition of the sketch; approximate surface of all the locality; separation into symmetrical groups in the case of several buildings; number of stories; surface of the ground floor; length and breadth of the building between its walls; distribution of each story; verification of the relation between the stories. Elevation of the building. Sketches. Memoir. General details, and details of execution.

Lecture 12.—Discussion before the abstraction of the measurements and the preparation of the estimate of the building.

Third Part.—First Section: On the Resistance of Materials.

Resistance of Materials.

1. Resistance of prismatic bodies to extension and compression. Elasticity of bodies. Modulus of elasticity. Limits of permanent efforts. Resistance to extension and compression of stone, bricks, and analogous materials; also of wood and metals. Applications.

APPENDIX I.—10. Construction.

2. Transverse resistance. Some cases in which it is brought into play. Results of experience. Resistance of bodies submitted to the effects of transversal flexure. Results of experience and conventions. Conditions ofequilibrium of bodies submitted to efforts directed transversal to their length. Direction and value of molecular efforts. Equation of the axis of the body. Equation of the squaring. Discussion of these equations.

3. Geometrical method for determining the inertia. Application to the research for the inertia of various sections. Applications of general equations of equilibrium and of squaring to straight pieces.

Resistance of Materials.

1st. A horizontal piece set in a frame at one extremity, and subjected to a weight acting at the other extremity, with a uniform vertical effect.

2nd. Horizontal beam placed upon two supports, and subjected to a weight acting at its centre, and with a uniform vertical effect.

3rd. Beam placed horizontally on two supports, and having two equal weights symmetrically placed with respect to its centre.

4th. Beam placed horizontally on two supports, and subjected to a weight acting at any point whatever throughout its length.

5th. Horizontal beam fixed at both its extremities, and subjected to a weight acting at its centre with an equal vertical effect.

6th. Horizontal beam placed on three points of support, at unequal distances, and weighted with two weights acting at the middle of the intervals between the supports.

7th. Vertical beam fixed at the foot, and charged with a weight acting at a certain distance from the axis of the beam.

5. Solids of equal resistances. Most suitable form for cast girders. Applications of the formula of equilibrium and squaring to various kinds of carpentry.

6. On polygonal roofs. Conditions respecting them. Arched roofs, pressure, &c. On the stability of walls required to resist the pressure of roofs.

SECOND SECTION: ON THE STABILITY OF REVETMEMT WALLS AND ARCHES.

Stability of walls and Arches.

7. On the pressure of earth. Explanation of the theory on Coulomb's system. Investigation of the pressure of earth by analysis. Hypothesis necessary in order to simplify the calculations. General formula of the value of the pressure, &c. Equations of stability and equilibrium under the hypothesis of slipping and rolling.

8. Simplification of the general equations of equilibrium in three particular cases. Determination of the coefficient of stability in Vauban's profile. M. Poncelet's formula for calculating the thickness of revetment walls with perpendicular face. Transformation of the profile of a revetment to another of equal stability. Vauban's counterforts, &c.

9. Geometrical method for determining the pressure of earth, whatever may be the profile of the wall and of the earth, taking into account the friction of the earth on masonry. Geometrical determination of the amount of the pressure. Proceeding for the determination, by geometry, of the thickness of a revetment wall at the level of the exterior ground.

10. On buttresses. Geometrical determination of the buttressing of earth, and of its momentum. Simplification of the geometrical constructions of the pressure, of the buttressing, and of their momenta under certain hypotheses.

11. Points of application of the pressure and of the buttress. 1st. In the case of a terrace sloping less than the natural slope of the ground. 2d. In the case of the ordinary revetments of fortification.

On the stability of the foundations of revetment walls.

Compressible soil. The resultant of all the forces should pass through the centre of the base. Size of the footing of the wall or depth of the foundations to arrive at the result. Possibility of the wall slipping over the base of the foundations. Use of the buttress to prevent this movement. Graphical method to determine the depth of the foundations. Depth of the foundations in unstable soil.

12. Pressure of arches. Case of cylindrical arches. Explanation of the theory of the pressure of arches. Point of application of the pressure in the five modes of possible rupture. Expression for the pressures and resistances by rolling or slipping. Proceeding to be followed to find by calculation the pressures and resistances.

13. Geometrical determination of the pressures and resistances by rolling. Explanation of the solution of this question. Construction of lines proportional to the surfaces of the voussoirs. 1st. In the case of an arch. Extrados without coping or additional weight. 2d. In that of an arch with extrados in the form of coping, and with or without additional weight. Construction of the verticals passing through the centre of gravity of the voussoirs. Abstract of the operations to be performed. Determination by geometrical means of the pressure and resistance against slipping.

14. Coefficient of stability of arches from the springing. Manner of finding the outline of an arch for a certain given coefficient. Stability of a cylindrical arch on its piers. Thickness of the piers. Considerations relative to the value of the coefficient of stability. Stability of an arch on the base of its foundations. Filling in and depth of the foundations of piers.

Extension of the geometrical methods serving for the determinations of the pressures and thicknesses of piers in case of cross vaulting, arcades, and spherical vaulting.

15. Investigation by analysis of the pressures and resistances of an arch. 1st. Hypothesis of a plat-band ; stability at the springing charge necessary on the coussinet; stability of the plat-band on its piers ; thickness of the piers. Squaring of a tie-beam of iron which annihilates the pressure. 2d. Hypothesis of a semicircular vaulting with arched extrados. Pressures and resistances. In similar arches the pressure is proportional to the square of the radius.

Fourth Part.—Hydraulic Construction.

Hydraulic Constructions.

1. Classification of ground on which it may be necessary to place a foundation. Soundings. Their object. Various kinds of sounding line. Dams in earth, and in wood and earth combined. Case of an unstable foundation. Construction on rock. Thickness of dams and of the clay work. General disposition of a dam. Bottom-springs. Means of choking or smothering them or of diverting them. Use of sunk dams. Service bridges. Their height and disposition. Railways in great constructions. Their disposition.

2d. Summary review of draining or pumping machines. Choice between the different methods of draining. Table of the useful effect of such machines.

Pile driving. Pile driving machine with hand ropes. Preparation of the pile and operation of driving. Pile driving machine with catch. Choice between the two kinds of pile driving machines. Precautions to be taken in the driving of piles. Distribution of piles, the space to be left between them, and the squaring of them. Disposition and driving of planks. Method of drawing up piles and planking. Execution of a foundation on piles. Driving stakes out of water. Machine for squaring piles.

3d. Parafouilles. Their object and construction.

Foundations in mortar under water. Preparation and immersion of the mortar. Examples.

Thickness of sunk dams with the enceint in mortar.

4th. Foundation frames and platforms. Their object and their construction. Preparation of the foundation frames in masonry.

Foundation by packing.

Foundation by cofferdams. Details of a cofferdam.

5th. Foundations on solid gravel. Properties of gravel. Case where it is advantageous to make use of gravel. Examples.

Foundations on sunk wooden piles, in gravel, and in gravel and mortar.

Foundation on pillars built in masonry.

Foundations on quicksand.

Species of foundation to adopt according to the nature of the ground.

6th. Banks of reservoirs. Conditions which should be fulfilled in their establishment. Banks in earth ; their profile ; revêtements to protect them; the wet slope; sort of remblai; precautions which exact a large remblai. Banks in remblai and sustaining walls combined. Banks entirely in masonry ; movements observed in walls; most suitable profile. Comparison between banks in earth and masonry. Works which are employed in connection with banks of reservoirs. Dikes of inundations. Their profile; defence of their slope against the action of water; their establishment and works in connection with them.

7th. Batardeaux in the ditches of strong places. Situation ; profile ; details of construction. Weirs. Their object ; effect of a weir in a current. Advantages of the wedge or circular form. Height to give to a weir ; and longitudinal form of the swelling occasioned by a horizontal dam. Construction of weirs with vertical walls, with a long slope down the stream. Injuries to which weirs are liable. Profile to adopt according to the nature of the ground.

8th. Sluice-dams, their object ; form of the piles ; distance apart, and dimensions. Details of construction. Various kinds of apparatus for opening and shutting sluice-dams. Play of a revolving gate. Calculation of the dimensions of the two half sluice gates and of the wicket. Carpentry of a revolving gate. Moveable dams with iron wickets. Modifications to render them applicable to the retention of water at a greater height than 2·80 metres.

9th. Navigable locks. Canal locks; its management: form of the chamber; profile of the cheeks. Trace of the pier on which the gates work. Means of filling and emptying the chambers. Means of raising the paddle-valves. Wood-work of the gates sheathed in timber. Planes. Details of the pivots, collars and rollers. Arrangements for the management of the sheathed gates.

10th. Gates sheathed in wood ; curves. Ties of cast iron, and lining in wood or sheet iron. Cast iron gates.

River Navigation.—Advantages and disadvantages of water transit. Conditions of a navigable river. Works for the improvement of the navigation on a river.

Artificial Navigation.—Classification of canals. Conditions which determine the best position for a summit level. Search after a minimum of elevation. Expenditure of water at the summit level.

APPENDIX I.—10.

Constructions.

11th. Principal processes employed to economise the water in passing through a lock. Profile of a navigable canal.

Deep cuttings; their profile. Great landslips and means of remedying them.

Tunnels; their profile. Piercing of a tunnel.

Bridges.

12th. Bridges in masonry. Position; breadth of the roadway; outlet to be left for the water; size and form of the arches; trace of the surbased arches on more than five centres. Expansion of the bridge heads. Profile of the arch. Thickness of the piles and abutments. Apparatus for the arches and bridgeheads. Parts above the arches. Levelling with the banks. Fixed and moveable centerings. Removal of the centerings of arches.

13th. *Wooden Bridges* composed of straight pieces. Arrangement of the stakes and starlings. Different construction of the openings according to their span. Arrangement of the platform.

American Bridges.—Arrangement of the earlist form of bridge on Town's system. Height of the trusses constructed in the form of trellis work. Modifications introduced to increase the resistance of the bridge. Calculation of the resistance of the trusses.

Arched frame-work of bridges. Composition of the arches. Junction of the straight beams with the arches.

Cast iron Bridges.—Different systems. General principles of their construction.

Aqueducts in masonry: in cast iron.

14th *Suspension Bridges.*—Equation of the curve of the chains and construction of this curve. Tension supported by the suspension cables, their thickness. Influence of the length of the flèche upon the tension of the cables. Inconveniences resulting from a long flèche. Vibrations and means of diminishing them. Limits of length of the flèche. Length of the curve of suspension. Causes operating to vary this length; means of obviating the effects produced by them. Length of the suspension rods. Number of supports to be adopted. Thickness of the piles. Points at which the fixing cables are to be attached. Advantages and disadvantages of chains composed of bars and of cables of iron wire. Some details of construction.

15th. *Drawbridges.*—Conditions which they must satisfy. General principle of their balance.

Drawbridges with Plyers.—Special theory of this bridge. Reduction of it to practice. Alteration of equilibrium and means of remedying it. Disadvantages of the drawbridge with plyers.

16th. Spiral drawbridge of Captain Berché. Trace of the spiral. Determination of the radius of the chain roller, and of the greatest radius of the spiral.

17th. Drawbridges with variable counterbalances, invented by M. Poncelet. Construction of the chains of the counterbalance. Establishment of the leverage. Calculation of the counterbalances for the special case of the pulleys in front corresponding to the axis of the platform. Influence of the nature of the chains. Method of allowing for the weight of the small chains. Definitive construction of the chains of the counterbalance.

Provision of loose cords.

Action of the Sea.

18th. Succinct ideas upon the motion of the sea, and its action on the shore.

Undulating movement. Height of the waves, and depth at which the agitation is perceptible. Effects of the waves on the coasts. Tides; spring-tides; neap-tides. Height of tides and hour of flood. General currents. Action of the sea on its shores. Protection of level and steep shores.

19th. Sea-ports. Requisites of a good port. Ports in the Mediterranean. Conditions of a good roadstead. Moles and breakwaters. Ocean ports, channel tide-dock, floating dock, and sluice of floating dock, laying-up dock, and sluice for the ditch of fortifications. General arrangemant of a harbour.

20th. Construction of moles. Stones dropped for foundations. Profile of a loose heap. Volume of the materials which insures their stability. Settling of masonry resting on a heap. Instances of masonry constructed at sea. 1. Wall of Cherbourg. 2. Fort Boyard.

Piers.—Direction, length, form of interval between, and profile of piers. Their construction. Passages reserved through piers.

Recapitulation.

Recapitulation.

First Part.—Parts of Buildings			18
Second Part.—Architecture of Military Buildings			12
Third Part.—	First Section. Resistance of Materials	6	15
	Second Section. Stability of Constructions	9	
Fourth Part.—Hydraulic Constructions			20
Total			65

Works of Application.

Name of the Work.	Number of Days allowed for the Execution of the Works to the Students of		Subject employed on.	Observations.
	Artillery.	Engineers.		
Survey of a Building:			Representation of an existing building or a part of a building by means of plans, sections, and elevations. The memoir contains an accurate and critical description of the distribution, construction, and decoration of the building.	Each day is equivalent to $4\frac{1}{2}$ hours' work. The sketches are executed to scales approximate to $\frac{1}{50}$ the whole drawing, of $\frac{1}{20}$ the large details, and of $\frac{1}{5}$ to $\frac{1}{2}$ for the minute details. The drawing prepared from the sketches is made on the scale of $\frac{1}{100}$.
Sketch (out-of-door work)	8	8		
Drawing	21 } 31	21 } 31		
Memoir	2	2		
Project for a Building:			Study and preparation of a project of a building in accordance with certain given data. The sketches, the result of the first study, are made in pencil; the drawing is the fair copy of the sketch, modified as may be necessary. The memoir contains an explanation of the rules and principles which must be observed in the construction of buildings, and the grounds on which the dispositions contained in the building have been adopted. The abstraction of the measurements and their reduction to the proper elements, and the estimates, are prepared in conformity to the instructions laid down for the Engineer Service in towns: these supply the estimated cost of the construction of the building according to the project.	This work, common to the students of the two arms, is an application of the first part of the course. The scale for the drawing is in general $\frac{1}{200}$ for the plans and elevations, and $\frac{1}{100}$ for the sections. It is restricted by the condition that the whole of the drawings should be given on a single sheet of paper. The details need only occupy half a sheet of paper, and its scales must depend on the size of the objects to be represented. The project for a building is an application of the two first parts of the course as well as of the 1st section of the 3rd part.
Sketch (1st study, in pencil)	12	12		
Drawing (fair copy)	18	18		
Details	4	4		
Memoir	4 } 42	4 } 42		
Abstraction of Measurements and Estimates	4	4		
Diagram of the Stability:			Determination of the profile for a revêtement wall, according to certain conditions. Verification of the stability of an arch, and calculation of the pier supporting this arch. In the memoir a short explanation is given of the theory relating to the strength of revêtement walls and arches, as well as the results of the application of these principles to the particular case.	The drawing is executed to the scale of $\frac{1}{100}$. This work is an application of the 2nd section of the 3rd part.
Drawing	6 } 9	6 } 9		
Memoir	3	3		
Project for an Hydraulic Construction:			Study and composition of a project for a great work of art on certain given data. In the memoir an explanation is given of the principles and the results of the theories which are to be applied in making this project. The arrangement adopted in the project are discussed for the foundation and all other parts of the construction.	The scale of the drawing is chosen in such a manner that the project may be placed on a single sheet; generally it is $\frac{1}{500}$, or even smaller. The project of an hydraulic construction is an application of the 1st section of the 3rd part as well as of the 4th part of the course.
Sketches	10	12		
Drawing	15 } 28	18 } 34		
Memoir	3	4		
Total	110	116		

APPENDIX I.—10,

Construction.

1st Lectures—Parts of the Course.	Artillery.					Engineers.					Observations.
	No. of Lectures.	Credits for Lectures.			No. of Interrogations.	No. of Lectures.	Credits for Lectures.			No. of Interrogations.	
		With application.	Without application.	Total.			With application.	Without application.	Total.		
1st Part :											
Elements of Masonry, form and dimensions of the different parts of buildings -	18	24*	6	30	2	18	24*	6	30	2	* A lecture with application is equivalent to $1\frac{1}{3}$ hours' of work, and a lecture without application is equal to 3 hours'.
2nd Part :											
Architecture of Military Buildings - - -	12	18	–	18	1	12	18	–	18	1	
3rd Part :											
Theory respecting Stability :											
1st Section—Resistance of Materials - - -	6	6	6	12	1	6	6	6	12	1	
2nd Section—Stability of revêtment walls and of arches - - - -	9	10·5	6	16·50	1	9	10·5	6	16·50	1	
4th Part :											
Hydraulic Constructions -	20	24	12	36	1	20	24	12	36	1	
Total - - -	65	82	30	112	6	65	82	30	112	6	

2nd. Execution of the Work.	Artillery. Number of						Engineers. Number of						Observations.
	Drawings and Sketches.	Memoirs.	Various.	Attendances in the Halls of $4\frac{1}{2}$ hours.	Attendances out of doors of 6 hours.	Credits.	Drawings and Sketches.	Memoirs.	Various.	Attendances in the Halls of $4\frac{1}{2}$ hours.	Attendances out of doors of 6 hours.	Credits.	
Plan of a Building :													† Of which 20 is for the out of door work, and 30 for the sketch. ‡ The time allowed for the preparation of the memoirs in the Halls should be doubled, in order to take an account of the correction out of the Halls of study.
Sketches (pen) - - -	1	–	–	–	8	50	1	–	–	–	8	50†	
Drawing - - - -	1	–	–	21	–	95	1	–	–	21	–	95	
Memoirs - - - -	–	1	–	2	–	20	–	1	–	2	–	20‡	
Project of a Building :													
Sketch - - - -	1	–	–	12	–	55	1	–	–	12	–	55	
Drawing - - - -	1	–	–	18	–	80	1	–	–	18	–	80	
Detail - - - -	1	–	–	4	–	20	1	–	–	4	–	20	
Memoir - - - -	–	1	–	4	–	35	–	1	–	4	–	35	
Abstraction of quantities and estimates - - -	–	–	1	4	–	20	–	–	1	4	–	20	
Diagram of Stability :													
Drawing - - - -	1	–	–	6	–	25	1	–	–	6	–	25	
Memoir - - - -	–	1	–	3	–	25	–	1	–	3	–	25	
Project of an Hydraulic Construction :													
Sketch - - - -	1	–	–	10	–	45	1	–	–	12	–	55	
Drawing - - - -	1	–	–	15	–	70	1	–	–	18	–	80	
Memoir - - - -	–	1	–	3	–	25	–	1	–	4	–	35	
Total - - -	8	4	1	102	8	565	8	4	1	108	8	595	

RECAPITULATION of the Credits of influence for the Course.

Artillery - { Lectures - - - 112 / Execution of Work - 565 } 677, or about 680

Engineers - { Lectures - - - 112 / Execution of Work - 595 } 707, or about 710.

11.—PROGRAMME OF THE COURSE IN THE GERMAN LANGUAGE.

APPENDIX I.—11. German language.

2d Division.—1st Year's Study.

Number of Lectures, 50.

Grammar and composition during the twenty-five Lectures forming the odd numbers.

Oral translations of German authors. Phraseology. Lecture on idioms, founded on the passages which have been translated and given in the form of conversation during the first half of the twenty-five Lectures forming the even numbers.

Dialogues and conversations, on various subjects of every-day life, such as are particularly useful to an officer travelling in Germany, carried on during the second half of the Lectures of the even numbers.

1st Division.—2d Year's Study.

Number of Lectures, 100

Translations of German authors, and conversations in German on the passages translated, during fifty Lectures, reckoning the odd numbers.

Military reconnaissances, in the form of a dialogue in German and in French, during the first half of the fifty Lectures, even numbers.

Translation of French into German: 1st, Narratives; 2d, Historical and descriptive fragments; 3d, Dramatic scenes; 4th, Epistolary style, during the second half of the fifty Lectures, even numbers.

At the close of the second year, the Sub-Lieutenants give in a composition on a certain subject.

The Sub-Lieutenants most advanced are not obliged to follow the course in German, but they should make translations of articles taken from German military works. These translations, after having been corrected, are deposited in the Library of the School.

Abstract of the course in German:—

1st year's study	- -	50 Lectures.
2d " "	- -	100 "
Total	-	150 at ¾ hour each—112. 3 0.

Credits of influence - - 110.

12.—PROGRAMME OF A SHAM SIEGE. (Common to the Artillery and Engineers.)

Sham siege.

Section I.—Preliminary Measures.

Art. 1.—*Commission charged to study the Project for a Sham Siege.*

Preliminary measures.

A Commission is charged with drawing up and presenting to the General commanding the School a project for a sham Siege. This Commission is composed of:—

The Colonel second in command of the School - President.
The Major of Artillery - - -
The Major of the Engineers - -
The Professor of Artillery - -
The Professor of Fortification - -
} Members.
A Clerk.

The Professors of Artillery and Fortification may be replaced by the Assistant Professors.

The General Commandant of the School decides in a Council of Instruction on the dispositions to be adopted for the project of a sham Siege.

Art. II.—*Preparatory Lectures.*

Preparatory lectures.

	Lectures.
By the Professor of Military Art - - - - - - - - -	2
1st. Considerations relating to the fortress of Metz. Circumstances which might bring on a siege of it. Force of the garrison and of the besieging army. Investment.	
2d. Trace of the lines of circumvallation and of countervallation.	
By the Professor of Topography - - - - - - - - -	1
Execution of the second reconnaissance plan (*memoire*), (1 lecture.)	
1st. Measure of the base. Plan of the ground of the attack. Construction of the plans. Plans of the works executed.	
By the Professor of Permanent Fortification - - - - - - -	2
1st. Discussion on the points of attack. Organization of the *personnel* and *materiél* of the Engineers of the Besieging Army and of the garrison.	
2d. General progress of the attack, and general dispositions of the defence.	
By the Professor of Artillery - - - - - - - - - -	2
1st. Composition of the personnel and materiél of the Artillery of the besieging army. Transport of the siege equipage.	
2d. General dispositions of the artillery in the attack and defence.	
Total Lectures - - - - -	7

APPENDIX I.—12

Section II.—Composition of the Personnel.

Sham Siege.

Director of the Siege.—The General Commandant of the School.
Chief of the Staff.—The Colonel Second in Command of the School.
Chief of the Artillery Service.—The Major of Artillery attached to the Staff of the School.
Director of the Park of Artillery.—This employment may be given to the preceding.
Chief of the Engineer Service.—The Major of the Engineers attached to the Staff of the School.
Director of the Engineer Park.—This employment may be given to the preceding.
Major of the Trenches.—A Captain.
Chiefs of Attacks.—Captains.
Chiefs of Brigades.—Named by the General Commandant of the Siege.

Secton III.—Conferences.

Conferences.

Before proceeding to the ground, the Sub-Lieutenants assist at conferences which are held for the purpose of explaining to them the successions of the several operations of the siege, as well as upon the traces which they have to execute. These conferences, eight in number, are divided in the following manner:—

The Chief of the Artillery Service will hold	4	conferences, and
The Chief of the Engineer Service	4	„
Number of conferences -	8	

Section IV.—Tracing of Lines and Topographical Work.

Tracing of lines and survey.

1st. The second reconnaissance survey (comprised in the course of topography.) Tracing of lines; one day is allowed for this work.

2d. "Director" plan. The execution of this plan comprises out-of-door work and drawing. The out-of-door work includes the measurement of one or many bases, the observation of the angles which are formed by this base, and the direction of certain remarkable points in the city and fortification, and the formation of a net-work of triangulation, intended to co-ordinate the surveys of the details.

The work of constructing the plan consists in laying down, day by day, the surveys of the details of the ground, as well as of the traces executed. Five days are allowed for the execution of the topographical work, which precedes the opening of the trenches. The Director Plan is kept close up during the whole duration of the siege.

3d. Itineraries and sketches (comprised in the course of topography.)

The Professor of Topography directs the whole of the surveys and the execution of the Director Plan.

Section V.—Tracing of the Works of Attack, and Actual Execution in full Relief of Certain Works.

Tracing the Works of Attack.

The sub-lieutenants, divided into brigades, trace the works of the siege, under the direction of the Officers of the Staff, and take part in the superintendence of the works executed in full relief when the exigencies of the service will permit the Chief of the Artillery Service and the Colonel of the Regiment of Engineers to place workmen at the disposal of the General Commandant of the School. Six days are appropriated to this work.

Section VI.—Work in the Halls of Study.

In-door Work.

The work in the Halls of Study consist of:—

1st. A memoir on the sham siege, which memoir must be approved by the General Commandant of the School.

2d. Of a sketch representing one of the works traced or executed in full relief. These works in the Halls are performed during the interval of the attendances devoted to out-of-door work. Two days are appropriated to the preparation of the memoir, and two to the execution of the sketch. This time is included in the eleven days allowed to the sham siege.

RECAPITULATION for the ARTILLERY and ENGINEERS. APPENDIX L—12.

Sham Siege.

Lectures and Conferences.	No. of Lectures or Conferences.	Credits for Lectures or Conferences.			No. of Questions.	Observations.
		Lectures.	Conferences.	Total.		
By the Professor of Military Art	2	3	—	3	2	One series of questions by the Chief of the Artillery Service, as to what relates to that arm. One series of questions by the Chief of the Engineer Service, as to what relates to that arm. A Credit of 11 is assigned to each series of questions.
„ of Topography	1	1½	—	1½		
„ of Permanent Fortification.	2	3	—	3		
„ of Artillery	2	3	—	3		
Conferences by the Chief of the Service of Artillery	4	—	6	6		
Conferences by the Chief of the Service of Engineers	4	—	6	6		
Total	15	10½	12	22½	2	

Recapitulation.

Works of Application.	Number of					Credits.	
	Drawings.	Memoirs.	Attendances out of doors.		Attendances in the Halls.		
			of 4½h.	of 8h.			
2nd Reconnaissance Plan (Memoir)							
Topographical Work	—	—	4	—	—	20	Credits given by the Professor of Topography.
Itinerary and Sketch (Memoir)	—	—	—	—	—	—	
Plan "Director"	—	—	—	—	1	5	
Tracing of Lines	—	—	—	1	—	10	Credits given by the Captains of the Staff, Chiefs of Brigades.
Tracing of Works of Attack and of Defence.	—	—	6	—	—	25	
Sketch	1	—	—	—	2	1	Credits given by the Chiefs of the Service of the Artillery and Engineers.
Memoir	—	1	—	—	2	2	
Total	1	1	10	1	5*	90	

RECAPITULATION.

Lectures and Conferences (in round numbers)	20
Works of Application	90
Total Credit for the Sham Siege	110

13.—PROGRAMME OF THE COURSE ON THE VETERINARY ART.

Veterinary Art.

1st PART.—INTERIOR OF THE HORSE.

Interior of Horse.

Lecture 1.—Classification and nomenclature of the various matters which constitute the horse. Skeleton (head and body).

Lecture 2.—Skeleton (limbs). Mechanical importance of the skeleton. Nomenclature and use of the muscles. Cellular and fatty tissues, grease, skin. Insensible perspiration.

Lecture 3.—Functions for maintenance. Arteries of the nerves. Animal heat.

Lecture 4.—On various functions.

2d PART.—EXTERIOR OF THE HORSE.

Exterior of Horse.

Lecture 5.—Proportions. Equilibrium. Description and importance of the natural beauties and defects of the head and region of the throat.

Lecture 6.—Description and importance of the other parts of the horse. Blemishes. Soft tumours.

Lecture 7. Osseous tumours. Various accidents. Temperaments. Description of clothing, &c.

Lecture 8.—Data respecting horses.

Lecture 9.—To know the age. On various bad habits. Examination of the eyes; their diseases.

Lecture 10.—Defective paces, &c. Draught and pack horses. Mules.

Lecture 11.—Stud and remounts. Races.

Lecture 12.—Vicious horses, and different bits. Manner of bitting a horse. On grooms and punishment.

* The attendances in the Halls should not count in the employment of the time, because each Sub-Lieutenant is not constantly occupied during the 11 days of out-of-door work, and should therefore make the sketch and memoir during the time left unoccupied.

APPENDIX I.—13.

Veterinary Art.

3d PART.—ON THE HEALTH OF THE HORSE.

Lecture 13.—Examination of the foot, and shoeing with the hot shoe.

Lecture 14.—Shoeing with the cold shoe. Different kinds of horse-shoe, &c.

Lecture 15.—On stables. Food. Rations.

Lecture 16.—Description and nomenlcature of the saddle. Harness and pack. Various saddles.

Lecture 17.—On work and rest. Horse and mule on the road and in bivouac. On diseases and accidents.

Abstract of the course:—

Interior of the horse -	4	17 lectures at $1\frac{1}{2}$ h.	Total time, $25\frac{1}{2}$ h.
Exterior - - - -	6		
Health - - - -	7	Credits, 25.	

The instruction on horseback can, under certain circumstances, be considered as connected with this course; and questions are asked during the time when the Sub-Lieutenants are not engaged in actual riding exercise. This instruction is described under the head of Practical Military Instruction: it comprises at the maximum 272 attendances, and its credit of influence is valued at 240.

Paris, *June 9th*, 1854.

The General of Division,
President of the Mixed Commission,
(Signed) VTE. DE LA HITTE.

Approved:

Paris, *July* 10*th*, 1854.

The Marshal of France,
Minister Secretary of State for War,
(Signed) VAILLANT.

APPENDIX J.

FURTHER PARTICULARS AS TO THE REGIMENTAL SCHOOLS OF THE ARTILLERY AND ENGINEERS.

Regimental Schools of Artillery and Engineers.

1. Artillery Regimental Schools.

Artillery Regimental Schools.

These are intended for the theoretical and practical instruction of officers, *sous-officiers*, and gunners. Object.

Each School is under the orders of the General of Brigade commanding the Artillery in the military division in which it is situated. Command and Staff.

Independent of the general officer, the school has the following staff:—

A Lieutenant (associated assistant to the General).

A Professor of Sciences, applying more particularly to the Artillery.

A Professor of Fortification, of drawing and construction of buildings.

Two *Gardes* of Artillery (one of the first, and the other of the second class).

There are, in addition, attached to each school the number of inferior officers (Captains, Lieutenants, or *Sous-Lieutenants*) required for carrying on the theoretical courses, which are not placed under the direction of the professors.

A Captain of the first class, assisted by two first Lieutenants, is the director of the park of the school. Another Captain, also of the first class, but taken from the regiment of Pontooneers, has the direction of that portion of the bridge equipage necessary for the special instruction of this corps, as well as of the material of the artillery properly belonging to this instruction.

The Lieutenant-Colonel, assistant to the General, fulfils, independent of every other detail of supervision with which he may be charged, the functions of *ordonnateur secondaire*, in what concerns the expenses of the school and their propriety (*justification*). He corresponds directly with the Minister of War for this part of the service.

The instruction is divided into *theoretical* and *practical*, and the annual course is divided into half-yearly periods, or into summer and winter instructions. Two half-yearly courses;

The summer instruction commences, according to different localities, from the 1st April to the 1st May, and that of the winter from the 1st October to the 1st November. one of Summer and one of Winter instruction.

The winter and summer instruction is subdivided into school and regimental instruction. Sub-divisions.

The school instruction comprehends all the *theoretical* and *practical* instruction common to the different corps which require the assistance of the particular means of the school, the employment of its professors, locality, and material, as that of the practical instruction in which the troops belonging to the different corps of the army are united to take part. School instruction.

The regimental instruction is that which exists in the interior of the regiments and the various bodies of the Artillery. It is directed by the chiefs of these corps, who are responsible for it, with the means placed at their disposal, under the general surveillance of the commandant of the school. Regimental instruction.

The special instruction of the Pontooneers not admitting of their following the same instruction as the other regiments of Artillery, the chief of this corps directs the special instruction according to certain bases prescribed by the regulations. Instruction of the Pontooneers.

There are for the Captains of Artillery, each year during the winter half-year, six conferences for the purposes of considering and discussing projects for the organization of different equipages and armaments for the field service, and for the attack and defence of places. Conferences for Captains.

In a building belonging to each School of Artillery, under the name of the hotel of the school, are united the halls and establishments necessary for the theoretical instruction of the officers and sous-officers, such as halls for *théorique* drill and drawing, library, depots of maps and plans, halls for machines, instruments, and models, &c. Accommodation provided in the building assigned for the School.

Each school is provided with a physical cabinet and a chemical laboratory. There is also a piece of ground, called a polygon, for exercising artillerymen to the manœuvres of cannon and other fire-arms of great range. Its extent is sufficient in length to furnish a range of 1,200 metres, and in breadth of 600 metres. The Polygon.

Permanent and temporary batteries are established on this ground, and they seem not only for practice, but also to accustom the men to the construction of fascines, field batteries, &c.

The administration of each school, and the accounts relating to it, are directed by an Administrative Council, consisting of— Administrative Council

The General Officer commanding the Artillery (President).

The Colonels of the regiments of Artillery in the towns where two regiments of the Artillery are quartered, and in other towns, the Colonel and Lieutenant-Colonel of the regiment.

The Colonel of the regiment of Pontooneers in the town where the principal part of the corps may be stationed, and in any other town the Lieutenant-Colonel or the Major.

The Lieutenant-Colonel associated assistant with the General Commandant.

APPENDIX J.

The functions of Secretary of the Council are entrusted to a *garde* of the first class.

Duties of the Intendants in connection with this Council.

The functionaries of the Corps of Intendants fulfil, in connexion with the Administrative Councils of the Artillery Schools, the same duties as are assigned by the regulations relating to the interior administration of bodies of troops. They will exercise over the accounts, both of money and material of the said schools, the same control as over the administration connected with the military interests of the state.

Engineer Regimental Schools.

2. Engineer Regimental Schools.

Command and Staff.

The Colonel of each regiment has the superior direction of the instruction.

The Lieutenant-Colonel directs and superintends, under his orders, the whole of the details of the regimental instruction.

A Major, selected from among the Officers of this rank belonging to the *état-major* of this arm, directs and superintends, under the orders of the Colonel, the whole of the details of the special instruction.

Regimental instruction and School instruction.

The complete instruction consists of—

General instruction, or that of the regiment, by which a man is made a soldier.

Special or school instruction, having for its object the training of the miner or sapper.

The instructions are each separated into *theoretical* and *practical* instruction.

Theoretical regimental instruction.

The theoretical instruction of the regiment comprehends the theories :—

On the exercises and manœuvres of infantry.
On the interior service.
On the service of the place.
On field service.
On the maintenance of arms.
On military administration.
On military penal legislation.

Practical instruction.

The practical instruction of the regiment comprises :—

The exercises and manœuvres of infantry.
Practice with the musket.
Military marches.
Fencing.

The teaching of these various duties is confided to Officers, *Sous-Officiers*, and Corporals of the regiments, as pointed out by the regulation, and the orders of the Colonel.

The fencing school is organized in a similar manner to those of the Infantry, and the military marches are also made in the same way as in those corps.

Theoretical school instruction.

The *special and theoretical* instruction consists of :—

Primary instruction.
Mathematics.
Drawing.
Geography.
Military history of France.
Fortification and the various branches of the engineering work.

Three civil professors (appointed by competition) are attached to each regimental school, for the special theoretical instruction, as regards the primary instruction, drawing, and mathematics.

The courses are distributed and taught in the following manner :—

Primary instruction for the Soldiers. French grammar for the Corporals. Book-keeping for the *Sous-Officiers*		By the Professor of Primary Instruction.
Elementary arithmetic for the Corporals.		By the Professor of Mathematics.
Complete arithmetic Elementary geometry	for the Serjeants.	
Complete geometry Trigonometry	for the Serjeant-Major.	
Surveys for the *Sous-Officiers*. Special mathematics for the Officers.		
Drawing for the Corporals and *Sous-Officiers*.		By the Professor of Drawing, who is also charged with completing the collection of models which relate to it.
The elements of fortification for the Serjeant-Majors.		By the Officers of the regiment, named by the Colonel, independently of those appointed by the regulations.
Construction, and theories on practical schools	for the *Sous-Officiers*.	
Permanent fortification The attack and defence of places Mines Bridges Ovens Topography	for the Officers.	
Geography Military history of France	for the *Sous-Officiers*.	

At the end of each course the Colonel of the regiment causes a general examination to be made in his presence of the whole of the men who have followed this course, and has a list made out in the order of merit, with notes of the capacity and aptitude of each.

These lists are consulted in the formation of tables of promotion, and placed with the said tables before the Inspector-General.

Each Captain and Lieutenant are obliged to give in at least a single treatise on five different projects, consisting of a memoir discussing or the journal of a siege, with drawing of the whole, and of details in sufficient number to render them perfectly intelligible.

Practical school instruction.

The *special practical* instruction is composed of seven distinct schools, relating to :—

Field Fortification.
Saps.
Mines and Fireworks.
Bridges.
Ovens.
Topography.
Gymnastics.

And they comprehend, in addition, sham sieges, and underground war. Each of these seven schools is taught in accordance with the special instructions annexed to the regulation, which, however, are not published.

Winter is more especially devoted to the course of special theoretical instruction, which commences on the 1st November, and usually finishes on the 15th March, and the course of *special practical* instruction is carried on during the summer from the 15 March to the 15th September. The second fortnight of September and the month of October are devoted to sham sieges and underground war, to the levelling of the works executed, and to the arrangement of the magazines.

At the end of each year of instruction, the Commandant of the school draws up a general report on the special instruction given to the regiment during the year. This report is divided into two parts, one relating to the theoretical, and the other to the practical instruction.

Administration.

The duties of the Colonel Commandant are, as regards the administration, analogous to those of the Commandants of the Artillery Schools.

The administrative control of the intendance is the same as for those schools.

APPENDIX K.

NOTICE OF THE PUBLIC SERVICES SUPPLIED BY THE POLYTECHNIC SCHOOL, OF WHICH NO ACCOUNT HAS BEEN GIVEN.

(*Taken from the Calendars of the School.*)

Gunpowder and Saltpetre.

(*Poudres et Salpêtres.*)

Poudres et Salpêtres. (*Gunpowder and Saltpetre Manufacture.*)

In France the manufacture of gunpowder is solely in the hands of Government. The pupils of the Polytechnic who enter the gunpowder and saltpetre service, are sent in succession to different powder mills and saltpetre refineries, so as to gain a thorough acquaintance with all the details of the manufacture.

On first entering the service they are named *élèves des poudres*. They afterwise rise successively to the rank of assistant commissary, commissary of the third, of the second, and of the first class.

Navy.

(*Marine.*)

Marine. (*Navy.*)

A small number of the pupils of the Polytechnic enter the Navy. They receive the rank of *élève de première classe*, from the date of their admission.

They are sent to the ports to serve afloat. After two years' service they may be promoted to the rank of *enseigne de vaisseau*, on passing the necessary examinations, on the same terms precisely as the *élèves de première classe* of the Naval School.

Marine Artillery.

(*Artillerie de la Marine.*)

Artillerie de Marine. (*Marine Artillery.*)

The French marine artillery differs from the English corps of the same name, in not serving afloat. Its duties are confined to the ports and to the colonies. It is governed by the same rules and ordinances as the artillery of the army.

The foundries of La Villeneuve, Rochefort, Ruelle, Névers, and Saint Gervais are under its direction.

The officers of the marine artillery are liable to be sent on board ship to study naval gunnery, so as to be in a position to report upon alterations or improvements in this science.

Naval Architects.

(*Génie Maritime.*)

Génie Maritime. (*Naval Architects.*)

The naval architects are charged with the construction and repair of vessels of war, and with the manufacture of all the machinery required in the ports and dockyards. The factories of Indret and La Chaussade are under their direction.

The pupils of the Polytechnic enter the corps of naval architects with the rank of *élève du Génie Maritime*. They are sent to the School of Application of Naval Architects at L'Orient. After two years' instruction they undergo an examination, and, if successful, they are promoted to the rank of sub-architect of the third class, so far as vacancies admit. They may be advanced to the second class after a service of two years.

Hydrographers.

(*Ingénieurs Hydrographes.*)

Ingénieurs Hydrographes. (*Hydrographers.*)

The hydrographers are stationed at Paris. They are sent to the coast to make surveys, and the time so spent reckons as a campaign in determining their pension. On their return to Paris they are employed in the construction of maps and charts.

The hydrographers have the same rank and advantage as the naval architects.

On leaving the Polytechnic, the pupils enter the corps of hydrographers with the rank of *élève hydrographe*. After two years' service, and one season employed on the coast, they become sub-hydrographers without further examination.

Roads and Bridges.—Government Civil Engineers.

(*Ponts et Chaussées.*)

Ponts et Chaussées. (*Government Civil Engineers.*)

The Polytechnic furnishes exclusively the pupils for the Government Civil Engineer Corps. On leaving the Polytechnic, the pupils enter the School of Application in Paris. The course of instruction here extends over a period of three years. It commences each

year on the 1st of November, and lasts till the 1st of April. After the final examination, the pupils are arranged according to the results of the examination and the amount of work performed.

The pupils enter the college with the rank of *élève de troisième classe*. They rise successively to the second and to the first class, on making the requisite progress in their studies.

Ponts et Chaussées

From the 1st of May to the 1st of November the *élèves* of the second and the third class are sent on duty into the provinces. The *élèves* of the first class who have completed their three years' course of instruction, are employed in the duties of ordinary engineers, or are detached on special missions. In about three years after quitting the college, they may be appointed ordinary engineers of the second class.

The engineers of the *Ponts et Chaussées* prepare the projects and plans, and direct the execution of the works for the construction, preservation, and repair of high roads, and of the bridges and other structures connected with these roads, with navigable rivers, canals, seaports, lighthouses, &c. They are charged with the superintendence of railways, of works for draining marshes, and operations affecting water-courses; they report upon applications to erect factories driven by water. Under certain circumstances, they share with the Mining Engineers the duty of inspecting steam-engines.

Permission is not unfrequently granted to the engineers of the *Ponts et Chaussées* to accept private employment. They receive leave of absence for a certain time, retaining their rank and place in their corps, but without pay.

Mining Engineers.

(*Mines.*)

Mines (*Mining Engineers*)

The Mining School of Application is organized almost exactly on the same plan as that of the *Ponts et Chaussées*: like the latter, it is in Paris.

The course of instruction, which lasts three years, consists of lectures, drawing, chemical manipulation and analysis, visits to manufactories, geological excursions, and the preparation of projects for mines and machines. Journeys are made by the pupils, during the second half of the last two years of the course, into the mineral districts of France or foreign countries for the purpose of studying the practical details of mining. These journeys last 100 days at least. The pupils are required to examine carefully the railroads and the geological features of the countries they pass through, and to keep a journal of facts and observations. In the final examination, marks are given for every part of their work.

The mining engineers, when stationed in the departments, are charged to see that the laws and ordinances relating to mines, quarries, and factories are properly observed, and to encourage, either directly or by their advice, the extension of all branches of industry connected with the extraction and treatment of minerals.

One of their principal duties is the superintendence of mines and quarries, in the threefold regard of safety of the workmen, preservation of the soil, and economical extraction of the minerals.

They exercise a special control over all machines designed for the production of steam, and over railways, as far as regards the metal and fuel.

The instructors in the School of Application in Paris, and in the School of Mines at St. Etienne, are exclusively taken from the members of the corps.

Like the engineers of the *Ponts et Chaussées*, the mining engineers obtain permission to undertake private employment.

Tobacco Department.

(*Administration des Tabacs.*)

Tabacs. (*Tobacco Department.*)

The pupils who enter the tobacco service, commence, on quitting the Polytechnic, with the rank of *élève de 2e classe*. They study, in the manufactory at Paris, chemistry, physics, and mechanics, as applied to the preparation of tobacco. They make themselves acquainted at the same time with the details of the manufacture and with the accounts and correspondence.

They are generally promoted to the rank of *élève de 1re classe* in two years. They rise afterwards successively to the rank of sub-inspector, inspector, and director.

After completing their instruction at the manufactory of Paris, the *élèves* are sent to tobacco manufactories in other parts of France.

Promotion in the tobacco service does not follow altogether by seniority. Knowledge of the manufacture and attention to their duties are much considered, as the interests of the Treasury are involved in the good management of the service.

Telegraphs.

(*Lignes Télégraphiques.*)

Lignes Télégraphiques. (*Telegraphs.*)

On entering the telegraphic service the pupils of the Polytechnic receive the rank of *élève inspecteur*.

APPENDIX K.

Public Services supplied by the Polytechnic Schools.

They pass the first year at the central office. During the six winter months they study, under two professors, the composition of signals, and the regulations which ensure their correctness and despatch, the working of telegraphs and the manner of repairing them, the theory of the mode of tracing lines and of determining the height of the towers, electro-magnetism and its application to the electric telegraph. During the summer months they make tours of inspection. They assist in the execution of works, and practise levelling and the laying down of lines.

Lignes Télégraphiques.

At the end of the year the *élèves inspecteurs* undergo an examination, and, if there are vacancies, are appointed provisional inspectors. After a year in this rank they may be appointed inspectors either in France or Algeria.

Each inspector has charge of a district containing from 12 to 15 stations. He is obliged to make a tour of inspection once a month of at least 10 days' duration.

After a certain number of years' service the inspector rises to the rank of director. Besides their other duties, the directors exercise a general superintendence over the inspectors

APPENDIX L.

COMMUNICATED BY M. TERQUEM, MEMBER OF THE INSTITUTE, LIBRARIAN OF THE DEPÔT CENTRAL D'ARTILLERIE.

NOTE SUR LES ECOLES MILITAIRES AUTRES QUE CELLES DE L'ARTILLERIE ET DU GENIE QUI EXISTAIENT EN FRANCE AVANT 1793.

Tout ce qui est relatif aux anciennes écoles militaires de France, autres que celles de l'Artillerie et du Génie, est contenu dans un ouvrage, qui a pour titre,—"Recueil des édits, "déclarations, ordonnances, arrêts, et règlements concernant l'Ecole Royale Militaire."—2 vol. in 4°. Paris, 1782. Il existe un autre ouvrage sous le même titre en 2 vol. en 8°, mais qui ne va que jusqu'en 1762, le 1er vol. et en 1769 le 2me.

Ce qui suit en est extrait.

Le premier document est un édit du mois de Janvier 1751, portant création d'une école royale militaire pour le logement, subsistance, entretien, et éducation dans l'art militaire de 500 jeunes gentilshommes. Establishment of a Military School in 1753 at Vincennes: transferred in 1756 to Grenelle.

Cette école fut établie provisoirement au mois d'Octobre 1753 dans le château de Vincennes pour 80 jeunes gentilshommes seulement, et au mois de Juillet 1756 elle fut transférée dans un grand hôtel neuf bati dans la plaine de Grenelle près Paris, qui recut le nom d'Ecole Militaire, nom qu'il a conservé, quoique depuis 1793 il ait changé de destination; il est depuis longtemps affecté au casernement des troupes.

L'école était gratuite. Une déclaration royale du 24 Août 1760 porte expressément que le but de l'école est double, savoir, un moyen de soulagement pour les familles nobles qui sont hors d'état de procurer une éducation convenable à leurs enfants, et un objet de récompense pour celles de ces familles qui se seraient vouées particulièrement à la défense de l'état. L'article 7 de cette déclaration statue qu'il ne sera reçu dans l'école aucun enfant dont les parents pourront se passer de ce secours pour l'education de leur famille. Education gratuitous and confined to persons of noble birth.

Les conditions d'admissibilité étaient:— Conditions of Admission.

1. Que les candidates eussent 8 ans au moins, et au plus 11 ans s'ils étaient orphelins.
2. Qu'ils fissent preuve de quatre générations de noblesse de père au moins; ces preuves, sur lesquelles on était sévère, devaient être faites par titres originaux devant le juge d'armes de la noblesse de France.
3. Qu'ils fussent indigents (ce sont les termes de la déclaration de 1760.) Les certificats d'indigence devaient être fournis par les sub-délégués des provinces, signés et attestés, conformes à la commune renommée, par deux des gentilshommes les plus voisins.
4. Que leur confirmation extérieure fût bonne.
5. Qu'ils sussent lire et écrire.

Le classement des élèves dans l'ordre d'admission était basé sur les considérations suivantes:— Order of Admission.

1. Les orphelins dont les pères avaient été tués au service ou étaient morts de leurs blessures.
2. Les orphelins dont les pères étaient morts au service ou s'en étaient retirés après 30 ans.
3. Les enfants qui étaient à la charge de leurs mères, leurs pères ayant été tués ou morts au service.
4. Les enfants dont les pères n'ont pas servi, mais dont les ancêtres ont été militaires.
5. Les enfants du reste de la noblesse dans le cas d'être secouru.

Le service militaire devait être fait dans l'hôtel pour former d'autant plus les élèves aux opérations pratiques de l'art militaire et les accoutumer à la subordination (1751, art. 6). Uniform.

L'uniforme était bleu, veste et parements rouges, boutons blancs, collet jaune.

L'ordonnance du 30 Janvier 1761 porte:—

Art. 1. Lorsque les élèves auront 18 ou 20 ans (non moins de 16, qui était à cette époque l'age nécessaire pour entrer dans les troupes), et que leur éducation se trouvera assez perfectionnée pour qu'ils puissent servir utilement l'état, ils seront employés dans les troupes et dans d'autres parties de la guerre.

Art. 2. Ceux qui auront de l'aptitude pour les mathématiques pourront, après les examens ordinaires, être admis à l'école du génie à Mézières en qualité d'ingénieurs.

Art. 3. De même, ceux dans lesquels on reconnaîtra de l'aptitude pour l'artillerie seront admis dans ce corps sans être obligés de passer par l'école des élèves d'artillerie, toutefois après avoir subi un examen à la Fère, où était l'école des élèves d'artillerie.

Art. 4. Les autres seront reportes dans l'infanterie, la cavalerie, et les dragons.

APPENDIX L.

Note sur les Ecoles Militaires, par M. Terquem.

En sortant de l'école militaire les jeunes officiers jouissaient sur les fonds de l'école d'une pension de 200 livres jusqu'à ce qu'ils fussent parvenus à des emplois dont le traitement fut de 1200 livres ou au-dessus.

En 1764 on reconnut que l'éducation toute militaire prescrite par l'édit de 1751 ne pouvait pas convenir à des enfants de 8 à 10 ou 13 ans au plus ; le roi, par une déclaration du 7 Avril 1764, divisa l'établissement, et transféra au collége de La Flêche les élèves depuis l'âge de 8 ans jusqu'à celui de 14. Le collége de La Flêche, créé par Henri IV. pour 100 jeunes gentilshommes pauvres, fut agrandi pour en recevoir 250, et devint une école preparatoire, comme il est encore aujourd'hui, sous le nom de collége militaire.

Military School of La Flêche.

En 1776 Raynal publia sous le titre ECOLE MILITAIRE, *ouvrage composé par ordre du gouvernement*, un recueil de traits *d'histoire militaire moderne*, depuis l'an 1494 jusqu'à l'an 1761, 3 vols. in 8vo.

Nature of the Instruction

En 1769 il parut un autre ouvrage destiné spécialement à l'école militaire : *Instructions sur le service de garnison et de campagne, dictées aux élèves de l'Ecole Militaire*, par Du Bousquet, Officier, &c. Paris 1769, 2 vols. in 12mo. Ce petit ouvrage fait connaître les matières qui composaient l'instruction militaire des élèves.

L'Encyclopédie au mot "Ecoles" donne quelques autres details à ce sujet dont il faudrait voir la date.

Age of entering the Army.

En 1770 un édit du 7 Septembre fixa à 18 ans accomplis l'âge auquel les élèves pourraient être admis dans les troupes, mais le Roi se reserva de pouvoir faire des exceptions à cette règle en favour des élèves qui auraient fait plus de progrés que les autres.

Ten new Military Schools, 1776.

En 1776, pendant le ministère du C^te^ de St. Germain, une ordonnance royale modifia profondément l'école royale militaire ; elle lui substitua dix nouvelles écoles royales militaires qui n'étaient autres que des colléges tenus par des ordres religieux ou des congrégations ecclésiastiques, colléges qui existaient et qui prirent le nom *d'Ecole royale militaire*, parceque l'on considérait l'institution de l'école de 1751, comme subsistant bien que partiellement dans ces nouvelles écoles.

Their object.

L'intention du roi, est il dit, était de procurer à la noblesse le precieux avantage de l'éducation publique, celui de ployer les caractères, d'étouffer l'orgueil des jeunes élèves nés dans la noblesse, parceque les écoles n'etaient pas exclusivement militaires et recevaient des enfants qui se destinaient à la magistrature.

Cost of Education.

Le gouvernement payait 700 livres de pension par élève, et les familles nobles qui pouvaient payer cette pension avaient la faculté d'y faire recevoir leurs enfants, sans qu'il y eut de distinction entre les élèves aux frais des familles et les élèves aux frais du gouvernement.

Annual Examination.

Tous les ans, au mois de Septembre, les uns et les autres, ayant, à l'age de 14 ou 15 ans, terminé leurs études, étaient admis au concours qui avait lieu à l'une des écoles, à celle de Brienne, pour être placés comme cadets gentilshommes dans les troupes, infanterie, cavalerie, ou dragons. Les cadets gentilshommes passaient successivement par tous les

Entry into the Army.

grades, en faisaient le service, étaient seulement exempts de corvée, et ensuite pouvaient être nommés *Sous-lieutenants*.

Localities of the ten Military Schools.

Les 10 écoles royales militaire étaient placées à Soreze, à Brienne, à Tiron (Département d'Eure et Loire), à Rebais (Seine et Marne), à Beaumont, Pontlevoy, Vendôme, Effiat, Pont à Mousson, et Tournon, toutes villes ou petites localités où il y avait déjà des ordres ou des congregations ; chaque école pouvait recevoir 60 élèves destinés aux armes.

Instruction.

Ces écoles étaient ce qu'on appelait et ce qu'on appelle encore aujourd'hui des colléges *de plein exercice ;* c'est-à-dire où l'on peut faire un cours *complet* d'études. On y enseignait l'écriture (c'est-à-dire à écrire), les langues Latine, Française, et Allemande, l'histoire, la géographie, les mathématiques, le dessin, la danse, la musique, et l'escrime.

On voit par l'énumeration des matières enseignées dans ces écoles qu'elles ne remplacaient pas l'ancienne école royale militaire de 1751.

The original Military School re-established on a new basis.

En 1777 une ordonnance royale du 17 Juillet établit un corps de cadets gentilshommes et un cours d'instruction à l'hotel de l'école royale militaire située dans la plaine de Grenelle, destinés à *l'élite des élèves* des dix écoles royales militaires, et en outre à des sujets choisis parmi la jeune noblesse, et élevés aux frais des familles. L'admission de ces sujets reposait toujours sur la preuve de quatre degrès de noblesse, qui étaient de rigueur. Le prix de la pension était de 2,000 livres par an, prix fort élevé pour l'époque, sans compter un trousseau de 400 livres.

Number of Pupils.

Le nombre n'en fut d'abord que de 50, mais il fut ensuite fort augmenté.

Une ordonnance royale du 18 Octobre 1777 donna au corps des cadets gentilshommes le nom de *compagnie*, fixa à 14 ans au moins et 16 ans au plus l'age d'admission, à deux ans la durée du cours d'études, qui embrassait les langues vivantes, l'histoire et la geographie, les mathématiques, la fortification et le dessin, la danse, l'escrime, l'équitation.

Staff.

Le personnel de l'école consistait dans un inspecteur genéral, gouverneur de l'école, 1 sous-inspecteur, 1 officier commandeur de la compagnie, 1 aide-major, 4 sous aide-majors, 1 commissaire de guerre, trois ecuyers, et un nombre assez considérable de maitres ou professeurs, 2 de fortification, 2 de dessin et figure, 3 de mathématique, 3 de langues, 2 de geographie, 1 de belles lettres, &c. (Voir l'Encyclopédie art militaire, article Ecoles milit.)

Appropriation of the Building of the Military School.

En 1787 les batiments de l'hotel de l'école royale militaire recurent une autre destination. Les élèves de l'école furent renvoyés, les uns dans les écoles des provinces, les autres dans

les régiments. L'hotel fut du nombre des 4 édifices de Paris destinés à remplacer l'hopital de l'hotel Dieu.

Ecoles pour l'Artillerie et pour le Génie.

Artillerie.—En 1679 on etablit une école d'artillerie à Douai, mais elle subsista peu de temps.

Artillery Schools.

Ce n'est qu'en 1720 sous Louis XV., lorsqu'on donna une nouvelle organisation au régiment royal d'artillerie, que l'on établit des écoles *de théorie* dans les sept villes ou il y avait des garnisons d'àrtillerie. L'instruction était bornée dans ces écoles à la théorie de l'artillerie.

Ce n'est qu'en 1756 que l'on créa une *école d'èlèves* à la Fère, avec 2 professeurs de mathématiques et 2 de dessin. En 1766 l'école fut transferée à Bapaume.

Engineer School.

Génie—La célèbre école de Mézières pour le génie a été créée en 1749. La 1ere promotion d'ingénieurs sortant de cette école eut lieu en 1750.

C'est sous le ministere du Cte. Voyen d'Argenson que furent créées en 1749 l'école du génie, en 1751 l'école royale militaire, et en 1756 l'école des élèves d'artillerie.

APPENDIX M.

TABLES SHOWING THE EMPLOYMEN

First and Second Companies and Student Sub-Officers of the 5th and 6th.

I.—Special Military School. Firs

Days of the Week.	5 A.M. to 5.15.	5.15 to 6.45.	6.45 to 8.	8 to 9.15.	9.15 t 9.30.
Monday -	Rise at 5. Entrance into the Halls of Study.	Study for the Lecture, or if there is no Lecture, General Study (*Etude libre.*)	"Rappel," for leaving study, breakfast, washing, &c. Inspection by the Captains. "Rappel," for Lecture; entrance into the Amphitheatres or Halls, or departure for out-of-door work.	Lectures. Military Administration, twelve Lectures, from November 12 to February 25. Military Legislation, ten Lectures, from March 4 to June 17, or General Study.	"Rappel," return to Study.
Tuesday -				German, twenty Lectures, from November 13 to April 30, or General Study.	
Wednesday				Fortification, twenty-seven Lectures, from November 14 to June 5, or General Study.	
Thursday -				Military Art and History twenty-seven Lectures, from November 15 to July 4, or General Study.	
Friday -				Topography, ten Lectures, two Conferences, from November 16 to March 15, or General Study.	
Saturday -				Artillery, fifteen Lectures, two Conferences, from November 17 to April 6, or General Study.	

	5.30 to 6.	6 to 7.30.	7.30 to 8.30.	8.30 to 10.
Sunday -	Rise, &c.	General Study.	Washing, &c., and Breakfast.	Inspection and Recreation

Third and Fourth Companies and Student Sub-Officers of the 7th and 8th.

II.—Special Military School. Firs

Days of the Week.	5 A.M. to 5.15.	5.15 to 6.45.	6.45 to 8.	8 to 9.15.	9.15 t 9.30.
Monday -	Rise, &c.	Study for the Lecture, or General Study.	"Rappel," leaving study, breakfast, washing, &c. Inspection by the Captains. "Rappel," for Lecture; entrance into the Amphitheatres or Halls of Study, or departure for out-of-door work.	Lectures. German twenty Lectures, from November 12 to April 29, or General Study.	"Rappel," return to Study.
Tuesday -				Military Administration, twelve Lectures, from November 13 to February 26. Military Legislation, ten Lectures, from March 5 to June 18, or General Study.	
Wednesday				Military History and Art, twenty-seven Lectures, from November 14 to July 3, or General Study.	
Thursday -				Fortification, twenty-seven Lectures, from November 15 to June 6, or General Study.	
Friday -				Artillery, fifteen Lectures, two Conferences, from November 16 to April 5, or General Study.	
Saturday -				Topography, ten Lectures, two Conferences, from November 17 to March 16, or General Study.	

	5.30 to 6.	6 to 7.30.	7.30 to 8·30.	8·30 to 10.	10 to 11.
Sunday -	Rise, &c.	General Study.	Washing and Breakfast.	Inspection and Recreation.	Mass and Recreation.

APPENDIX M.

OF TIME AT ST. CYR.

First and Second Companies and Student Sub-Officers of the 5th nnd 6th.

(JUNIOR) DIVISION. WINTER SERVICE.

9.30 to 11.15.	11.15 to 1 P.M.	1 to 2.	2 to 6.15.	6.15 to 6.30.	6.30 to 8.30.	8.30 to 9.	Day of the Week.
STUDY on the Lecture, or GENERAL STUDY. INTERROGATIONS.	GRAPHICAL WORK. — FORTIFICATION (Drawing.)	"Rappel," leaving study. Dinner. Recreation. "Rappel," for exercises.	Exercise. Military study. Drill-book. Fencing, musketry practice, artillery, manœuvres, &c.	"Rappel," recreation. "Rappel," return to study.	General study. Interrogations.	Supper. Recreation. Bed.	Monday.
	TOPOGRAPHY (do.)						Tuesday.
	FORTIFICATION (do.)						Wednesday.
	TOPOGRAPHY (do.)						Thursday
	FORTIFICATION (do.)						Friday.
	COMMON DRAWING (*Dessin d'imitation.*)						Saturday.

10 to 11.	11 to 12.	12 to 12.30.	12.30 to 8.30.	
Mass and Recreation.	General Study.	Dinner.	Recreation, &c.	Sunday.

Third and Fourth Companies and Student Sub-Officers of the 7th and 8th.

(JUNIOR) DIVISION. WINTER SERVICE.

9.30 to 11.15.	11.15 to 1 P.M.	1 to 2.	2 to 6.15.	6.15 to 6.30.	6·30 to 8·30.	8.30 to 9.	Days of the Week.
STUDY on the Lecture, or GENERAL STUDY. INTERROGATIONS.	GRAPHICAL WORK. — TOPOGRAPHY.	"Rappel," leaving study. Dinner. Recreation. "Rappel," for exercises.	Exercises. Military study. Drill-book. Fencing, musketry practice, artillery manœuvres, &c.	"Rappel," recreation. "Rappel," return to study.	General Study. Interrogations.	Supper. Recreation. Bed.	Monday.
	FORTIFICATION.						Tuesday.
	TOPOGRAPH.						Wednesday.
	FORTIFICATION.						Thursday.
	COMMON DRAWING (*Dessin d'imitation.*)						Friday.
	FORTIFICATION.						Saturday.

11 to 12.	12 to 12.30.	12.30 to 7·30.	7.0 to 8.30.	
General Study.	Dinner.	Recreation, visits from friends, &c.	Supper, Recreation, Bed.	Sunday.

Fifth and Sixth Companies.

III.—Special Military School. Second

Days of the Week.	5 A.M. to 5.15.	5.15 to 6.45.	6.45 to 8.	8 to 9.15.	9.15 to 9.30.
Monday -	Rise at 5. Entrance into the Halls of Study.	Study for the Lecture, or if there is no Lecture, General Study (*Etude libre*).	"Rappel," leaving study, breakfast, washing, &c. Inspection by the Captains. "Rappel" for lecture; entrance into the Amphitheatres or Halls of Study; departure for out-of-door work.	Lectures. Descriptive Geometry, twenty-seven Lectures, from November 12 to June 3, or General Study.	"Rappel," return to study.
Tuesday -				Military Geography and Statistics, twenty-seven Lectures, from November 13 to June 4, or General Study.	
Wednesday				Physical Sciences applied to Military Arts, thirty-five Lectures, from November 9 to July 10. General Study, from the end of the course to the end of the year.	
Thursday -				History, thirty-five Lectures, from November 8 to July 11, or General Study.	
Friday -				German, thirty Lectures, from November 9 to May 31, or General Study.	
Saturday -				Military Literature, twenty Lectures, from November 10 to May 4, or General Study.	

	5.30 to 6.	6 to 7.30.	7.30 to 8.30.	8.30 to 10.	10 to 11.
Sunday -	Rise, &c.	General Study.	Washing, Breakfast.	Inspection and Recreation.	Mass and Recreation.

Seventh and Eighth Companies.

IV.—Special Military School. Second

Days of the Week.	5 A.M. to 5.15.	5.15 to 6.45.	6. 45 to 8.	8 to 9.15.	9.15 to 9.30.
Monday -	Rise at 5. Entrance into the Halls of Study.	Study on the Course. General Study (*Etude libre*).	"Rappel," leaving study, breakfast, washing, &c. Inspection by the Captains. "Rappel" for lecture; entrance to the Amphitheatres.	Lectures. Military Geography and Statistics, twenty-seven Lectures, from November 12 to June 3, or General Study.	"Rappel," return to study.
Tuesday -				Descriptive Geometry, twenty seven Lectures, from November 13 to June 4, or General Study.	
Wednesday				History, thirty-five Lectures, from November 7 to July 10. General Study, from the end of the course to the end of the year.	
Thursday -				Physical Science applied to Military Arts, thirty-five Lectures, from November 8 to July 11. General Study, from the end of the course to the end of the year.	
Friday -				Military Literature, twenty lectures, from November 9 to May 3, or General Study.	
Saturday -				German, thirty Lectures, from November 10 to June 1. General Study from the end of the course to the end of the year.	

	5.30 to 6.	6 to 7.30.	7.30 to 8.30	8.30 to 10.	10 to 11.
Sunday -	Rise, &c.	General Study.	Washing and Breakfast.	Inspection and Recreation.	Mass and Recreation.

OF TIME AT ST. CYR – *continued.*

(Senior) Division. Winter Service.

Fifth and Sixth Companies.

9.30 to 11.15.	11.15 to 1 p.m.	1 to 2.	2 to 6.15.	6.15 to 6.30.	6.30 to 8.30.	8.30 to 9.	Days of the Week.
Study on the Lecture, or General Interrogations.	Graphical Work. — Diagrams (*Epures*).	"Rappel," leaving study. Dinner. Recreation. "Rappel" for exercises.	Exercise. Military study. Drill-book. Gymnastics, musketry practice, &c.	"Rappel," recreation. "Rappel," return to study.	General study. Interrogations. Compositions.	Supper. Recreation. Bed.	Monday.
	Common Drawing (*Dessin d'imitation*).						Tuesday.
	Diagrams.						Wednesday.
	Common Drawing						Thursday.
	Sketches in Physical Science.						Friday.
	Sketches in Geography.						Saturday.

11 to 12.	12 to 30.12.	12.30 to 7.30.	7.30 to 8.30.	
General Study	Dinner.	Recreation, &c.	Supper, Recreation, Bed.	Sunday.

(Senior) Division. Winter Service.

Seventh and Eighth Companies.

9.30 to 11.15.	11.15 to 1 p.m.	1 to 2.	2 to 6.15.	6.15 to 6.30.	6.30 to 8.30.	8.30 to 9.	Days of the Week.
Study on the Lecture, or General Study. Interrogations.	Graphical Work. — Common Drawing (*Dessin d'imitation*).	"Rappel," leaving study. Dinner. Recreation. "Rappel" for exercises.	Exercises. Military study. Drill-book. Gymnastics, musketry practice, &c.	"Rappel," recreation. "Rappel," return to study.	General study. Interrogations. Compositions.	Supper. Recreation. Bed.	Monday.
	Diagrams (*Epures*).						Tuesday.
	Common Drawing.						Wednesday.
	Diagrams.						Thursday.
	Sketches in Geography.						Friday.
	Sketches in Physical Science.						Saturday.

11 to 12.	12 to 12.30.	12.30 to 7.30.	7.30 to 8.30.	
General Study.	Dinner.	Recreation, &c.	Supper, Recreation, Bed.	Sunday.

First and Second Companies and Student Sub-Officers of the 5th and 6th.

V.—Special Military School. Firs

Days of the Week.	4. 30 A.M. to 4.45.	4.45 to 7. 15.	7.15 to 8.15.	8.15 to 9.30	9.30 to 9.45.	9.45 to 11.15.
Monday -	Rise.	Exercises.	Breakfast, washing, &c. Inspection by the Captains. "Rappel," entrance into the Amphitheatres or Halls of Study.	Lectures. — Military Legislation.	"Rappel," return to study.	Study on the Lecture, or General Study, from the end of the course to the end of the year. Interrogations.
Tuesday -				German.		
Wednesday				Fortification.		
Thursday -				Military Art and History.		
Friday -				Topography.		
Saturday -				Artillery.		
Sunday -	5.30. to 6. Rise &c.	6 to 7.30. General Study.		8.30. to 10. Inspection and Recreation.		10 to 11. Mass and Recreation.

Third and Fourth Companies and Student Sub-Officers of the 7th and 8th.

VI.—Special Military School. Firs

Days of the Week.	4.30 to 4.45 A.M.	4.45 to 7.15.	7.15 to 8.15.	8.15 to 9.30.	9.30 to 9.45.	9.45 to 11.15.
Monday -	Rise.	Exercises.	Breakfast, washing, &c. Inspection by the Captains. Entrance into the Amphitheatres or Halls of Study.	Lectures. — German.	"Rappel," return to study.	Study on the Subject of the Lecture, or General Study from the end of the course to the end of the year. Interrogations.
Tuesday -				Military Legislation.		
Wednesday				Military Art and History.		
Thursday -				Fortification.		
Friday -				Artillery.		
Saturday -				Topography.		
Sunday -	5.30 to 6. Rise, &c.	6 to 7.30. General Study.	7.30 to 8.30. Washing and Breakfast.	8.30 to 10. Inspection and Recreation.		10 to 11. Mass and Recreation.

OF TIME AT ST. CYR.—*continued.*

(JUNIOR) DIVISION. SUMMER SERVICE.

First and Second Companies and Student Sub-Officers of the 5th and 6th.

11.15 to 1 P.M.	1 to 2.	2 to 4.	4 to 6.	6 to 6.15.	6.15 to 8.	8 to 8.30.	Days of the Week.
GRAPHICAL WORK. — FORTIFICATION or GENERAL STUDY, from the end of the Drawing to the end of the year.	"Rappel," leaving study. Dinner. Recreation. "Rappel," return to study.	Drill-book, musketry practice, fencing, &c. for the Infantry. Drill-book for the Cavalry.	Study and Interrogations for the Infantry. Study for part of the Cavalry. Riding (*manége ou carrière*) for the other part.	"Rappel," recreation. "Rappel," return to study.	Study and Interrogations for the Infantry, and for a part of the Cavalry. Riding from 6 to 8 for the other part of the Cavalry.	Supper. Recreation. Bed.	Monday.
TOPOGRAPHY, do.							Tuesday.
FORTIFICATION, do.							Wednesday.
TOPOGRAPHY, do.							Thursday.
FORTIFICATION, do.							Friday.
——							Saturday.

11 to 12.	12 to 12.30.	12.30. to 7.30.	7.30 to 8.30.	
General Study.	Dinner	Recreation, &c.	Supper, Recreation, Bed.	Sunday.

(JUNIOR) DIVISION. SUMMER SERVICE.

Third and Fourth Companies and Student Sub-Officers of the 7th and 8th.

11.15 to 1 P.M.	1 to 2.	2 to 4.	4 to 6.	6 to 6.15.	6.15 to 8.	8 to 8.30.	Days of the Week.
GRAPHICAL WORK. — TOPOGRAPHY and GENERAL STUDY, from the end of the Drawing to the end of the year.	"Rappel," leaving study. Dinner. Recreation. "Rappel," return to study.	Drill book, musketry practice, fencing, &c. for the Infantry. Drill-book for the Cavalry.	Study and Interrogations for the Infantry. Study for a part of the Cavalry. Riding (*manége en carrière*) for the other part.	"Rappel," recreation. "Rappel," return to study.	Study and Interrogations for the Infantry, and part of the Cavalry. Riding from 6 to 8 for the other part of the Cavalry.	Supper. Recreation. Bed.	Monday.
FORTIFICATION, do.							Tuesday.
TOPOGRAPHY, do.							Wednesday.
FORTIFICATION, do.							Thursday.
COMMON DRAWING, (*Dessin d'imitation.*)							Friday.
FORTIFICATION, do.							Saturday.

11 to 12.	12 to 12.30.	12.30 to 7.30.	7.30 to 8.30.	
General Study.	Dinner	Recreation; visits from friends; march in the country (*promenade militaire*), or general study.	Supper, Recreation, Bed.	Sunday.

Fifth and Sixth Companies.

VII.—Special Military School. Second

Days of the Week.	4.30 A.M. to 4.45.	4.45 to 7.15.	7.15 to 8.15.	8.15 to 9.30.	9.30 to 9.45.	9.45 to 11.15.
Monday -	Rise.	Exercises.	Breakfast, washing, &c. Inspection by the Captains. Entrance into the Amphitheatres or Halls of Study.	Lectures. — Descriptive Geometry.	"Rappel," recreation. "Rappel," return to study.	Study on the Lecture, or General Study. Interrogations.
Tuesday -				Military Geography and Statistics.		
Wednesday				Physical Sciences applied.		
Thursday -				History.		
Friday -				German.		
Saturday -				Military Literature.		
Sunday -	5 to 6. Rise, &c.	6 to 7.30. General Study	7.30 to 8.30. Washing and Breakfast.	8·30 to 10. Inspection and Recreation.	10 to 11. Mass and Recreation.	

Seventh and Eighth Companies.

VIII.—Special Military School. Second

Days of the Week.	4. 30. A.M. to 4. 45.	4.45 to 7.15.	7.15. to 8.15.	8.15 to 9.30.	9.30 to 9.45.	9.45 to 11.15.
Monday -	Rise.	Exercises.	Breakfast, washing, &c. Inspection by the Captains. Entrance into the Amphitheatres or Halls of Study.	Lectures. — Military Geography and Statistics.	"Rappel," recreation. "Rappel," return to study.	Study on the Lecture, or General Study. Interrogations.
Tuesday -				Descirptive Geometry.		
Wednesday				History.		
Thursday -				Physical Science applied.		
Friday -				Military Literature.		
Saturday -				German.		
Sunday -	5.30 to 6. Rise; entrance to Study.	6 to 7.30. General Study.	7.30 to 8.30. Washing and Breakfast.	8.30 to 10. Inspection and Recreation.	10 to 11. Mass and Recreation.	

OF TIME AT ST. CYR.—*continued.*

(Senior) Division. Summer Service. Fifth and Sixth Companies.

11·15 to 1 p.m.	1 to 2.	2 to 4.	4 to 6.	6 to 6.15.	6.15 to 8.	8 to 8.30.	Days of the Week.
Graphical Work. Diagrams (*Epures*), General Study, from the end of the Drawing to the end of the year.	"Rappel," leaving study. Dinner. Recreation. Roll-call, return to study.	Drill-book, gymnastics, &c. for the Infantry. Drill-book for the Cavalry.	Study and Interrogations for the Infantry. Study for a part of the Cavalry. Riding for the other part of the Cavalry.	"Rappel," recreation. "Rappel," return to study.	Study and Interrogations for the Infantry, and for part of the Cavalry. Riding from 6 to 8 for the other part of the Cavalry.	Supper. Recreation. Bed.	Monday.
Common Drawing (*Dessin d'imitation*).							Tuesday.
Diagrams.							Wednesday.
Common Drawing.							Thurs
Sketches in Physical Sciences.							Friday.
Sketches in Geography							Saturday.

11 to 12.	12 to 12.30.	12.30 to 7.30.	7·30 to 8.30.	
General Study.	Dinner.	Recreation, &c.	Supper, Recreation, Bed.	Sunday.

(Senior) Division. Summer Service. Seventh and Eighth Companies.

11.15 to 1 p.m.	1 to 2.	2 to 4.	4 to 6.	6 to 6. 15.	6.15 to 8.	8 to 8.30.	Days of the Week.
Graphical Work. Common Drawing (*Dessin d'imitation*). General Study, from the end of the Drawing to the end of the year.	"Rappel," leaving study. Dinner. Recreation. "Rappel," return to study.	Drill-book, gymnastics, &c. for the Infantry. Drill-book for the Cavalry.	Study and Interrogations for the Infantry. Study for part of the Cavalry. Riding for the other part.	"Rappel," recreation. "Rappel," return to study.	Study and Interrogations for the Infantry and part of the Cavalry. Riding from 6 to 8 for the other part of the Cavalry.	Supper. Recreation. Bed.	Monday.
Diagrams (*Epures*) (do.)							Tuesday.
Common Drawing (do.)							Wednesday.
Diagrams (do.)							Thursday.
Sketches in Geography.							Friday.
Sketches in Physical Science.							Saturday.

11 to 12.	12 to 12.30.	12.30 to 7.30.	7.30 to 8.30.	
General Study.	Dinner.	Recreation, &c.	Supper, Recreation, Bed.	Sunday.

APPENDIX N.

SCHOOL OF APPLICATI

TABLE I.—EMPLOYMENT OF TI

FIRST DIVISION.

Rise at $6\frac{3}{4}$ A.M. 7 — 8 — 9 — 10 — 1 P.M. — $2\frac{1}{2}$ — 4

DAYS.	Morning Exercise.	Riding. German.		Graphical Work. Interrogations.	Lectures by the Military Professors.	Riding. Drawing.	Study.
Monday 7, 14, 21, 28.	Drill-book.	Fatigue Duty. (*Travail militaire.*)	Interval for Breakfast.	Topography.	Geodesy.	Drawing	General Study (*étud libre*).
Tuesday 1, 8,15,22,29.	General Study. Fencing.	German.		Fortification.	Fortification.	Riding (*Manége civil*).	Ditto.
Wednesday 2, 9,16,23,30.	Hippology.	Riding. (*Promenade à cheval*).		Topography.	Geography.	Drawing.	Ditto.
Thursday 3, 10,17,24,31.	General Study. Fencing.	German.		Memoir on the design for Field Fortification.	Military Administration and Legislation.	Riding.	Ditto.
Friday 4,11, 18, 25.	Drill-book.	Fatigue Duty.		Topography.	Military Art.	Drawing.	Ditto.
Saturday 5, 12, 19, 26.	General Study. Fencing.	German.		Artillery.	Artillery.	Riding.	Ditto.

TABLE II.—EMPLOYMENT OF TI

FIRST DIVISION.

Rise at $5\frac{3}{4}$ A.M. 6 — $7\frac{1}{2}$ — 9 — 10 — 1 P.M. — $2\frac{1}{2}$ — $3\frac{1}{2}$

DAYS.	Morning Exercise.	Riding. German.		Graphical Work. Interrogations.	Lectures of the Military Professors.	Study.	Riding. Drawing.
Monday 5, 12, 19, 26.	Drill Book.	Fatigue Duty. (*Travail militaire.*)	Interval for Breakfast.	Topography.	Geodesy.	General Study. (*Etude libre.*)	Drawing.
Tuesday 6, 13, 20, 27.	General Study, Fencing.	German.		Fortification.	Fortification.	Ditto.	Riding (*Manége civil.*)
Wednesday 7, 14, 21, 28.	Hippology.	Riding. (*Promenade à cheval.*)			Geography.	Ditto.	Drawing.
Thursday 1, 8, 15, 22, 29.	General Study. Fencing.	German.		Artillery.	Military Administration and Legislation.	Ditto.	Riding.
Friday 2. 9. 16, 23, 30.	Drill Book.	Fatigue Duty.		Topography.	Military Art.	Ditto.	Drawing.
Saturday 3. 10, 17, 24. 31.	General Study. Fencing.	German.		Fortification.	Artillery.	Ditto.	Riding.

APPENDIX N.

FOR THE STAFF.

FOR THE MONTH OF JANUARY 1856.

SECOND DIVISION.

Rise at $6\frac{3}{4}$ 7	8	9	10	1	$2\frac{1}{2}$	4	5
DAYS.	Morning Exercise.	Riding. German.		Graphical Work. Interrogations.	Lectures by the Military Professors.	Riding. Drawing.	Study.
Monday 7, 14, 21, 28.	Study. Fencing.	German.	Interval for Breakfast.	Topography.	Astronomy.	Riding. (*Manége civil.*)	General Study. (*Etude libre.*)
Tuesday 1, 8, 15, 22, 29.	Drill-book for Cavalry.	Fatigue Duty.		Applied Geometry. (*Epure d'ombres*).	Applied.	Drawing.	Ditto.
Wednesday 2, 9, 16, 23, 30.	Study. Fencing.	German.		Topography.	Military Art.	Riding.	Ditto.
Thursday 3, 10, 17, 24, 31.	Hippology.	Riding.		Applied Geometry.	Military Administration.	Drawing.	Ditto.
Friday 4, 11, 18, 25.	Study. Fencing.	German.		Topography.	Topography.	Riding.	Ditto.
Saturday 5, 12, 19, 26.	Drill-book for Cavalry.	Fatigue Duty.		Applied Geometry.	Applied Geometry.	Drawing.	Ditto.

FOR THE MONTH OF MAY 1856.

SECOND DIVISION.

Rise at $5\frac{3}{4}$ 6	$7\frac{1}{2}$	9	10	1	$2\frac{1}{2}$	$3\frac{1}{2}$	5
DAYS.	Morning Exercise.	Riding German.		Graphical Work. Interrogations.	Lectures.	Study.	
Monday 5, 12, 19, 26,	Study. Fencing.	German.	Interval for Breakfast.	Topography.	Astronomy.	General Study. (*Etude libre.*)	
Tuesday 6, 13, 20, 27.	Drill Book for Cavalry.	Fatigue Duty.		Applied Geometry. (*Perspective à vue.*)	Applied Geometry.	Ditto.	Drawing.
Wednesday 7, 14, 21, 28.	Study. Fencing.	German.		Topography.	Military Art.	Ditto.	
Thursday 1, 8, 15, 22, 29,	Hippology.	Riding.		Applied Geometry. (*Cadran solaire.*)	Fortification.	Ditto.	Drawing.
Friday 2, 9, 16, 23, 30.	Study. Fencing.	German.		Topography.	Topography.	Ditto.	
Saturday 3, 10, 17, 24, 31.	Drill Book for Cavalry.	Fatigue Duty.		Applied Geometry. (*Cadran solaire.*)	Military Administration.	Ditto.	Drawing.

APPENDIX O

UPPER CADE

TABLE OF THE DISTRIBUTION OF TIME FOR TH

		8	9	10	1
Monday	I.	Tactics.	Tactics.	Military Literature.	
	II.	Tactics.	Fortification.	French.	
Tuesday	I.	Fortification.	Fortification.	Drawing.	
	II.	Arms and Munitions.	Tactics.	English.	
Wednesday	I.	Philosophy.	Surveying Ground and Positions.	Arms and Munitions.	
	II.	Fortification.	German.	Surveying Ground and Positions.	
Thursday	I.	Mathematics.	Mathematics.	Fortification.	
	II.	Arms and Munitions.	Tactics.	Drawing.	
Friday	I.	Tactics.	Tactics.	Military Literature.	
	II.	Fortification.	French.	English.	
Saturday	I.	Philosophy.	Surveying Ground and Positions.	Arms and Munitions.	
	II.	Fortification.	Arms and Munitions.	Surveying Ground and Positions.	

APPENDIX P.—No. 1.

DISTRIBUTION OF TIME OF THE ARTILLERY AN

Days.	Hours.	FIRST YEAR, OR CŒTUS. Division A.	Division B.	Hours.	SECOND Division A.
Monday	8 — 9	Tactics.	Mathematics.	8 — 9	Mathematics.
	9 — 10	Ditto.	Ditto.	9 — 10	Ditto.
	10 — 11	Rules of the Service (*Dienstkenntniss*).	Theory of Surveying	10 — 11	Special Engineering (*Besondere Ingenieur Kenntniss*).
	11 — 12	Mathematics.	General Engineering (*Ingenieur Kenntniss*).	11 — 12	Fortification Drawing.
	12 — 1	Ditto.	Ditto.	12 — 1	Ditto.
	3 — 4	——	Drill.		
Tuesday	8 — 9	French.	Geometric Drawing.	8 — 9	Natural Philosophy.
	9 — 10	Plan Drawing.	Plan Drawing.	9 — 10	Ditto.
	10 — 11	Ditto.	Ditto.	10 — 11	Special Engineering.
	11 — 12	General Engineering (*Ingenieur Kenntniss*).	Artillery.	11 — 12	Plan Drawing.
	12 — 1	Ditto.	Ditto.	12 — 1	Ditto.
	4 — 6	Gymnastics.	Gymnastics.	4 — 5	French.
Wednesday	8 — 9	Mathematics.	Theory of Surveying.	8 — 9	History of Art of War.
	9 — 10	Ditto.	Tactics.	9 — 10	Fortification Drawing.
	10 — 11	Theory of Surveying.	Ditto.	10 — 11	Ditto.
	11 — 12	Artillery.	Mathematics.	11 — 12	Mathematics.
	12 — 1	Ditto.	Ditto.	12 — 1	Ditto.
Thursday	8 — 9	Artillery.	French.	8 — 9	Geometric Drawing.
	9 — 10	Engineering.	Artillery.	9 — 10	Artillery Drawing.
	10 — 11	Ditto.	Ditto.	10 — 11	Ditto.
	11 — 12	Plan Drawing.	Plan Drawing.	11 — 12	History of Art of War.
	12 — 1	Ditto.	Ditto.	12 — 1	Ditto.
	3 — 4	Drill.	——		
Friday	8 — 9	French.	Tactics.	8 — 9	Natural Philosophy.
	9 — 10	Artillery.	Ditto.	9 — 10	Ditto.
	10 — 11	Theory of Surveying.	Drill.	10 — 11	Artillery.
	11 — 12	General Drawing (*freies-hand-zeichniss*).	General Engineering.	11 — 12	Artillery Constructions, Drawing.
	12 — 1	Ditto.	Ditto.	12 — 1	Ditto.
	4 — 6	Gymnastics.	Gymnastics.	4 — 5	French.
Saturday	8 — 9	Tactics.	French.	8 — 9	Special Engineering.
	9 — 10	Ditto.	Mathematics.	9 — 10	Mathematics.
	10 — 11	Geometric Drawing.	Ditto.	10 — 11	Ditto.
	11 — 12	Mathematics.	General Drawing.	11 — 12	Artillery.
	12 — 1	Ditto.	Ditto.	12 — 1	Ditto.
				2 — 4	——

APPENDIX O.

School at Berlin.

Two Divisions of the Highest Class, or Selecta.

11	12	2	3	4
		French.	German.	Division. I. } Monday.
Military Literature.		Fortification.	Arms and Munitions.	II. } Monday.
Drawing.		Military Composition, Military Service, Military Law.	Arms and Munitions.	I. } Tuesday.
German.		Arms and Munitions.	Military Composition, Service, and Law.	II. } Tuesday.
		Chemistry.	Chemistry.	I. } Wednesday.
				II. } Wednesday.
Fortification.		French.	German.	I. } Thursday.
Drawing.		Chemistry.	Chemistry.	II. } Thursday.
		Fortification.	Fortification.	I. } Friday.
Military Literature.		Mathematics.	Mathematics.	II. } Friday.
		Arms and Munitions.		I. } Saturday.
		Tactics.		II. } Saturday.

APPENDIX P.—No. 1.

Engineers School for the Year 1855–56.

Year. Division B.	Hours.	Third Year. Division A.—Artillerymen.	Third Year. Division B.—Engineers.	Days.
Natural Philosophy.	8 — 9	——	Hydraulic Construction.	Monday.
Ditto.	9 — 10	Artillery Drawing.	Fortification Drawing.	
Artillery.	10 — 11	Ditto.	Ditto.	
	11 — 12	Artillery.	Exclusive Engineering (*Ausschliessische Ingenieur Kenntniss*).	
Mathematics.				
Ditto.	12 — 1	Ditto.	Ditto.	
	2 — 3	——	Riding.	
History of Art of War.	8 — 9	——	Exclusive Engineering.	Tuesday.
Ditto.	9 — 10	Artillery.	Ditto.	
Artillery.	10 — 11	Ditto.	Architectural Drawing.	
Fortification Drawing.	11 — 12	Chemistry.	Ditto.	
Ditto.	12 — 1	Ditto.	Hydraulic Construction.	
French.	3 — 4	French.	French.	
Mathematics.	8 — 9	Mathematics.	Mathematics.	Wednesday.
Ditto.	9 — 10	Ditto.	Ditto.	
History of Art of War.	10 — 11	Artillery Constructions, Drawing.	Exclusive Engineering.	
Fortification Drawing.				
Ditto.	11 — 12	Plan Drawing.	Ditto.	
	12 — 1	Ditto.	Hippology.	
	1 — 2	——	Ditto.	
Special Engineering.	8 — 9	Hippology.	Chemistry.	Thursday.
Plan Drawing.	9 — 10	Ditto.	Ditto.	
Ditto.	10 — 11	Artillery.	Exclusive Engineering.	
Natural Philosophy.	11 — 12	Ditto.	Fortification Drawing.	
Ditto.	12 — 1	Artillery Constructions, Drawing.	Ditto.	
	2 — 3	——	Riding.	
Artillery.	8 — 9	Artillery.	Exclusive Engineering.	Friday.
Special Engineering.	9 — 10	Ditto.	Ditto.	
Ditto.	10 — 11	Artillery Drawing.	Architectural Drawing.	
Architectural Drawing.	11 — 12	Chemistry.	Plan Drawing.	
	12 — 1	Ditto.	Ditto.	
Ditto.	3 — 4	French.	French.	
French.				
Geometric Drawing.	8 — 9	——	Exclusive Engineering.	Saturday.
Plan Drawing.	9 — 10	Mathematics.	Mathematics.	
Ditto.	10 — 11		Ditto.	
Mathematics.	11 — 12	——	Chemistry.	
Ditto.	12 — 1	——	Ditto.	
Drawing.	2 — 3	——	Riding.	

APPENDIX P.

Appendix P.—No. 2.

I.

Table of the Practical Exercises during the Course of the Theoretic Instruction for 1856.

Class.	Exercises.	Days of Practice.	Time employed.
I.	1. Inspection of the collection of arms in the Arsenal	1	End of February.
	2. Inspection of cannon, gun carriages, and ammunition waggons.	4	Beginning of March (4 days are here added in).
	3. Inspection of the artillery workshops	4	End of March.
	4. Visiting and working in the laboratories	12	In April and May.
	5. Visiting the engineers' working ground	2	Middle of May.
	6. Visiting the cannon foundry at Spandau	1	End of May.
	7. Inspecting the models of fortification in the Arsenal	1	
	8. Inspection of the fortress of Spandau and the powder manufactory.	1	
	9. Geodetic exercises	12	In June.
	10. Examinations of small arms	2	End of June.
II.	1. Working in the laboratories	12	In April and May.
	2. Practical exemplification of the rules of placing cannon on the ground.	2	Beginning of June.
	3. Drawings of cannon, gun carriages, ammunition waggons.	12	In June.
III.	1. Visiting the artillery workshops, and inspection of the raw material.	4	Beginning of March.
	2. Practical exemplification of the rules of placing cannon according to given tactical positions.	4	Middle of March.
	3. Examination of guns	6	End of March.
	4. Examination of gun carriages and ammunition waggons.	6	Beginning of April.
	5. Inspection of the cannon foundry, as well as exercises in the art of fortification and besieging, at Spandau.	3 — 5	End of April.
	6.	2	Beginning of May.
	7. Visit to the iron foundry, and to a large machine manufactory.	2	Middle of May.
	8. Drawing of buildings.	14	In April and May.

II.

Table of the Practical Exercises during the Summer Months of 1856.

Class.	Exercises.	No. of Days employed.	Time employed.
I.	1. Tactical exercises	4	From 1st to 4th of July.
	2. Geodetic exercises	16	From 5th to 20th of July.
	3. Fortification exercises	12	From 21st of July to 2d of August.
	4. Allowed for passing the Officer Examination.	14	From 4th to 16th of August.
	5. Preparation for firing practice	2	19th and 20th of August.
	6. Firing practice	14	From 22d of August to 5th of September.
II.	1. Fortification exercises and inspection of the models of fortresses in the model house.	12	From 1st to 18th of July.
	2. Allowed for passing the Examination for a Commission in the Artillery or Engineers.	5	
	3. Geodetic exercises	28 —'32	From 20th of July to 20th of August.
	4. Examination in surveying	1	21st of August.
	5. Firing practice	14	From 22d of August to 5th of September.
III.	For passing the second half of the examination for the Commission in the Artillery or Engineers.	5	From 1st to 5th of July.

Appendix P.—No. 3.

Artillery and Engineers School.

Outlines and Text Books introduced 1853–54.

SUBJECTS.	Class (or Year) I.	Class II.	Class III.
Artillery.	Outlines of Artillery. Lectures, 1851.	Outlines of Artillery. Lectures, 1851.	Outlines of Artillery. Lectures, 1853.
Engineering. (*Ingenieur Kenntniss*).	The instruction is given according to the teacher's notes, as the outlines are not yet completed.		
Elementary Tactics.	Outlines of Tactics, 1850.	——	——
History of Art of War.	——	Outlines of History of Art of War. 1840.	——
Mathematics.	Lehmus' Pure Mathematics and the Mechanical Sciences, 1845.	Lehmus' Pure Mathematics and the Mechanical Sciences, 1845.	*For the 1st Division.*— Lehmus' Short Guide to higher Analysis, higher Geometry, and Analytical Mechanics, 1842. *For the 2d Division.*— The same as Class II.
Theory of Surveying.	Outlines of Plan Drawing, Topography and Surveying, 1850.	——	——
Natural Philosophy.	——	Müller's Outlines of Experimental Physics. Third Edition. 1852.	——
Chemistry.	——	——	Werther Inorganic Chemistry, 1st and 2d Division, 1850 and 1852.
French.	Ségur, Histoire de Napoléon et de la Grande Armée. Fränkel, Anthology of French Prose Writers, 1850.	Delavigne, Louis XI. Fränkel, Anthology of French Prose Writers, 1850.	Schiller, The Parasite.
Hippology.	——	——	Hertwig, Handbook of General Hippology, 1851.
Geometrical Drawing.	Outlines of Geometrical Drawing, 1851.	Same Outlines as in Class I.	——

APPENDIX Q.

PROGRAMMES OF THE PRINCIPAL SUBJECTS TAUGHT IN THE ARTILLERY AND ENGINEER SCHOOL AT BERLIN.

1. ARTILLERY.

1. Extent of instruction.

THE instruction must commence with the first elements of the science, since the new arriving students have little preparatory knowledge. It must be carried on to such an extent that the pupil may be able, after going through the first cœtus, to pass his *officer's examination*, and after the completion of the entire course, not only to show at his *special* examination that he possesses the positive knowledge required for the ordinary duties of the service, but also to prove that he is qualified for continuing his studies by himself.

The Engineer pupils who close their instruction in artillery at the end of the second cœtus, are to be instructed in the composition of artillery, in the effect and the use of cannon, but more especially in its employment in sieges.

From this general notice of the limits of the course it is evident that neither a perfect exposition of the theory nor complete practical exercises are expected. Still to train the students properly in the different directions which an artillery education requires, the instruction must not consist only in a theoretical lecture, but be aided by judicious directions for drawing, and be perfected by practical exercises. For the attainment of the two latter objects special prescriptions are given, to which we refer.

2. Connexion of the different studies one with another.

Instruction in artillery is closely connected with the lectures on mathematics, physics, chemistry, tactics, fortification, and veterinary science.

a. As special points may be mentioned, *in mathematics*, calculation of contents, and fixing the centres of gravity, of cannon and its parts ; calculation of piles of shot: strength, direction, and distribution of recoil on the separate portions of a piece of ordnance ; theory of machines, of carriages, of parabolic and projectile curves, and calculation of the flight of rockets. In all these cases the mathematical lecturer develops the necessary formulas for, the artillery student, but their application belongs to the course of artillery.

b. *In physics.*—Explanation, notice, and determination of the specific gravities of the materials used in artillery. The law of gravity. The absolute and relative strength of woods and metals. Friction. Resistance of the air. Expansive power of gases, especially of those generated by gunpowder.

c. *In chemistry.*—The general laws of chemical action of bodies on one another. The simple elements of the materials used in artillery. The chemical properties of their combinations. The acids exhibited in the combustion of gunpowder and their action on metals ; the processes used in the reduction and manufacture of metals up to the point where they are fit for use in artillery: chemical analysis of gunpowder and of the most common metal-alloys. The action of the atmosphere on substances exposed to it, which are used in artillery.

d. *In tactics.*—The organization and tactics of artillery, so far as they stand in direct relation to other arms. A complete account of the conduct of artillery when co-operating with other troops.

e. *In fortification.*—Everything referring to the tracing, the relief, and the construction of fortifications; attack and defence of field works by infantry and cavalry ; complete exposition of the art of besieging, with a discussion of all the duties of an engineer, a sapper or miner, both in the attack and the defence of a fortress, also the use of infantry and cavalry in sieges, with the omission of the points specially belonging to artillery.

f. *In the veterinary art.*—The anatomy and physiology of the horse ; general rules for feeding, treatment of diseases, and disinfection of the stables and utensils.

3. Principal subjects of the lectures in each cœtus, and division of time.

The instruction in the first cœtus must, as already mentioned, be so calculated, that the students at the end of the course of lessons may be able to satisfy perfectly the requirements of the *Officer's examination.*

As a further prosecution of the same subjects of instruction in the second, and again in the third cœtus, would lead to a great loss of time and to tiresome repetitions, the lectures are to be so planned that the separate subjects to be treated in the first and second cœtus, taken together, are of sufficient extent for the Engineer pupils in general; the farther developments necessary for the Artillery pupils are reserved in preference for the third cœtus.

A. In the First Cœtus.

The separate subjects of the lecture are—

1. Definition and distribution of arms

2. Theory of gunpowder: component parts—manufacture—ignition—force. Proving. Storing. Transporting. Necessary precautions in manufacturing. Marks of damaged powder, and the possibility of restoration. Mention of the substances which may be used in place of gunpowder for various military purposes.

3. Cannon. Materials. Dispositions. Manufacture. Proving. Storing, and duration.

4. Gun carriages. Limbers and other artillery carriages. General explanations on the construction of carriages, with particular reference to those used for artillery. Materials. Distribution and composition of gun carriages. Limbers and waggons. Their examination and storing.

5. Military combustibles. Elementary notions. General account of laboratory work and regulations; also with reference to later proceedings in a laboratory, and, omitting all figures not absolutely necessary, a description of the preparation of fireworks, matches, ammunition both for artillery and for small arms, signal lights, and particular kinds of combustibles. Their packing and storing.

6. The service, working, and moving of cannon, and of artillery carriages, with account and description of the machines in use by the Prussian artillery; but without special explanation of the official regulations.

7. Firing. Theory of the movement of projectiles, of the effect caused by their movement, and the mode of turning this action to the best account for military purposes. Elements of the theory of firing. Practice. Various descriptions of fire; their effect, and their employment for various sorts of guns.

8. Small and side arms. Purpose and description of the composition and arrangement of small arms. Their manufacture, storing, and the practical rules for their use. Purpose and description of side arms. Fabrication, proving, effect, and use of them.

B. In the Second Cœtus.

The instruction in the second cœtus is a continuation of the lectures of the first cœtus, and embraces the use of artillery in the field and in sieges. Its object is to bring the Artillery students to that point that they are able, at its close, to discharge satisfactorily the ordinary practical duties of the service, and be prepared to follow the course of the third cœtus, and to give to the Engineer students, who, in the third cœtus no longer receive instruction in artillery, all the knowledge of the subject required for their future profession. The instruction must therefore be complete enough for the Engineers, and give the Artillerist a solid and thorough preparation for the third cœtus.

Instruction in the second cœtus should comprise, in particular—

1. The organization of the artillery: purpose and considerations in the putting together of all parts of artillery material, both in tactical and administrative respects, with historical mention of the diversities of practice of other Powers.

2. The use of artillery in the field. Marching and tactical movements. Taking up position. The engagement itself, and conduct in some particular cases; for example, in defile fighting, in entrenchments, passage of rivers, &c.

3. Use of artillery in sieges:—

a. *For Attack.*

Planning and throwing up the batteries. Preparation and use of the different kinds of materials of construction. Different sorts of batteries. Methods of construction. Repairing of damaged batteries, and the calculation generally of all the materials necessary for constructing them.

Purpose and equipment of besieging batteries, with the preparations, special and general, for a regular attack.

Proceedings in the regular attack, and their modifications in irregular sorts of attack, occasioned by the situation of the fortress with reference to the surrounding ground, or by the special nature of the defences.

Proceedings after capture, and when the siege is raised.

b. *For Defence.*

The equipment of the fortress. Determination of its artillery. Preparations in the fortress when it is declared in a state of siege. Conduct of the artillery in the regular attack, and against irregular modes of attack, as well as in particular cases, such as when in detached isolated works, when the place is relieved, or when the garrison fight its way out.

C. In the Third Cœtus.

In the artillery course of the first and second cœtus, the students have gained a general knowledge of the materials of artillery, as well as its organization and use as an Arm; but the lectures were for the most part limited to what was of the greatest immediate consequence, viz., the description of the actual condition and relations of the Prussian artillery.

APPENDIX Q.
ARTILLERY.

The object of the instruction given in the third cœtus is, on the one hand, to expose the scientific laws of artillery and its various parts, and, on the other, to track the historical development of the Arm, so as by this means, and by consideration of the constitution of foreign artilleries, to extend the views of the students beyond our own practice, thus to form their judgment, and induce them to think and contrive for themselves.

In the comparison of our own and foreign existing systems with the results of scientific considerations, the teacher should proceed with caution, and not raise in the young men the inclination to or the habit of crude and officious criticism. Investigation of things as they exist must, therefore, not confine itself to the mere search after defects; it can be only profitable when employed to test our own powers at improvements, and to discern thereby the difficulties and impediments that accompany them. The value which speculative reasoning has for the purposes of the artillery ought to be properly esteemed by the students, but, in face of the results of experience, not be estimated too highly; and in the comparison of different artilleries one with another, the influence must not be overlooked which the peculiarities and the history of a country ever exert on its institutions.

The final aim of the artillery instruction in the third cœtus must be a higher degree of preparation for the future practical ability of the students. As regards the material portion of the artillery, the students are to acquire a general knowledge of the construction, fabrication, and proving of the *matériel*, and for the tactical part, it is above all things to be made an object that they be made capable, by the instruction given them, of greater dexterity and confidence in dealing with special cases in the field or in siege operations.

The instruction commences with:—

1. Organization of the artillery service. The general relations of the artillery service are to be explained according to its different purposes, as an arm both in technical and administrative respects, then the principles for the organization of the service and of its separate portions in peace and war are to be developed, and comparison made with those carried out in the principal foreign artilleries.

At the same time, on the one hand, more details are to be gone into on the different branches of the artillery service (field, siege, fortress, and coast artillery, the technical and the administrative branches,) than was done in the second cœtus; and on the other, those considerations must be kept sight of in which the artillery appears as a portion of a greater whole, as in its relation to the Army and to the State.

2. Artillery, regarded as an arm. Since the elementary rules for the use of artillery in war have been given already in the second cœtus it will be the object in the third cœtus, first, to develop the principles of artillery tactics in the field, and in sieges, from an extended point of view, and then to apply the rules for the movements, placing in position and fighting of the artillery to the bodies now actually used in war, and to examine the great questions that may hence arise. For the field artillery, the tactics of single batteries and of masses of artillery, and the collective relations of the artillery of a *corps d'armée* and of an army, must be shown. For sieges there will be less occasion to treat of the separate means of defence by artillery than of the various combinations under different circumstances, of its diversified applications.

To give this instruction its most practical tendency, historical examples of battles are to be taken, and not merely their results adduced, but the circumstances gone through in detail. These are to be compared with the rules previously given, and the causes and effects of any discrepancies, as far as practicable, and with caution, explained.

Themes are then given out of campaigns and sieges, in working which the students are to show applications of tactical rules under given circumstances.

As regards the preparation for the field and the conduct in marches, quarters, camps, or bivouacs, what was necessary has already been taught in the second cœtus, as far as concerns a corps of artillery as large as a battery. In the third cœtus, therefore, only more extensive and important relations have to be explained.

Finally, as the students at the close of the third cœtus are to enter immediately into active service in the regiments, it will be useful to give them a general view of artillery duties in time of peace, of which no mention was made in the first and second cœtus, and to show the principles on which they rest. Further, the education of the men, the selection, management, and care of the artillery horses, instruction in riding and driving, the various exercises in serving and moving the guns, artillery practice, the different fatigue duties, conduct in manœuvres, detachments, &c., are to be particularly explained.

3. Artillery in a technical and administrative point of view.—In the instruction given in the first and second cœtus, a descriptive notice only was given, as regards artillery material, of the arrangement and effect of what actually exists; and the reasons for this arrangement were added only so far as was necessary for this principal object.

In the third cœtus the pupils are to learn by the inductive process how, according to existing principles of natural science and of tactics, with the known mathematical and technical aids, artillery material must be constructed, manufactured, and proved, so as to obtain the desired end in the highest degree; and then our existing material and that of other countries are to be compared in the manner above stated with the results thus obtained.

To this end, in the lectures, first, the necessary explanations of artillery requirements are to be brought forward from the doctrine of mechanics; after that the fabrication,

proving, and action of gunpowder are to be introduced; and, finally, the construction, fabrication, and examination of cannon, carriages, and ammunition of the artillery and of small arms.

Of course the details of powder mills, of cannon foundries, of artillery workshops, of laboratories, and small arms manufactories, are here to be explained.

The action of projectiles and the mode of applying it, are to be scientifically explained, by the aid of the parabolic and projectile theory, as well as the principles upon which artillery experiments are to be conducted.

Finally, the principles of the management of the artillery material in the artillery depôts are to be explained.

4. The course of instruction will be closed by an historical description of the progress of artillery, and by an historical review of its literature.

D. General Distribution of the Time.

The total number of hours is, according to the constitution of the school—

For the first cœtus, 35 weeks of 4 hours = 140 hours.
„ second „ 35 „ 3 „ = 105 „
„ third „ 35 „ 8 „ = 280 „

The exact number of hours dedicated to each division must be stated by the teacher in the first instance in his special plan of lessons, as they in part depend upon his general experience. But, at all events, all the above-stated subjects for the first cœtus must be taught in the prescribed periods.

The lecture in the first cœtus must by no means be a mere mechanical preparation for the *Officer's examination*; even here the understanding of the pupil is not to remain unoccupied, though the memory is to be had recourse to in a very high degree, and the historical form, that is, description of objects as they are, predominates.

4. Method and means of instruction.

The principles of the arrangements can only be taken up in their chief features, (partly because) time will not allow a farther advance, and partly because the progress of the students in the other studies is not yet sufficiently forward.

In the second cœtus the advantage has been obtained that the students have gained a knowledge of the entire material of artillery in its various relations, and the lecture gives, therefore, an introduction to the use of artillery in the field and in sieges; and with special regard to a fundamental knowledge of the details, and with the view to what is necessary to complete the Engineer pupil and make an efficient preparation of the Artillerist for the third cœtus, aims at a somewhat more scientific treatment, without going into the full comprehensive details reserved for the latter student. For the same reason, this portion of the lectures is confined nearly throughout to the explanation of existing conditions of our artillery, and only where the necessities of the Engineer student may demand it, can mention be made of the earlier material, or of the most important matters of foreign artilleries.

The instruction, therefore, of the first and second cœtus is directed more to the general and historical, that of the third cœtus, more to the special and scientific culture of the student; the materials were there collected which are here to be worked up.

From this general point of view proceed also the methods which are to be observed by the teachers in each cœtus.

The principal point to be kept hold of in all three cœtus is, that everything that can be shown the students, or which they can learn by their own manipulation, should be brought visibly before them, and as far as time and circumstances permit, should be actually put in practice. The material objects, in their actual state for use, must as often as possible be shown and explained, for which the Practical Exercises offer the best opportunity, to which reference is here therefore made.

After these, a collection of models, diagrams, tables, and literary notices are necessary, which may be partly used for immediate instruction in the class, and partly furnished the pupils as a necessary and time-saving aid to the memory.

Deficiencies in these aids to the lectures are to be laid before the Direction and Board of Studies by the teacher, and supplied as far as the existing means allow.

Those cases in which the proceedings are fixed by certain regulations require special mention; for instance, the transport of powder, examination of cannon, drills, harnessing of horses, stable and camp service, &c.

All these regulations are grounded on certain principles, from which no deviation can take place without evil. The method of drawing them up is, however, variable, on which times and circumstances, and even the views of the superior authorities, have influence.

It is, therefore, highly necessary that in this respect the essential be carefully in the instruction separated from the accidental, and by omitting the latter, not only gain time, but hinder that the students accustom themselves in a slovenly manner to look only to forms, and to seek in them the true being and life of artillery.

A true exposition of the principles on which these regulations rest ought not to be omitted from the lectures. They will suffice to prepare the students to act correctly in every case that occurs, for which actual service gives them, moreover, the separate instruction. The more completely the teacher keeps this point in view the less need he fear to form his pupils to immature critics, since the well-informed officer will

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more easily enter into the spirit of each such regulation, and tmore exactly carry it into execution for the benefit of the service, than he who has been accustomed to keep without reflection only to the dead letter; this, in the varied phases of practical life, will often enough leave him without guidance, unless he knows how to find it within himself.

As amongst the many existing class and hand books for the artillery, none is entirely adapted to form a basis for the lectures, the formation of a special plan of lectures for each cœtus is indispensable, that the lecturer may have a defined path, and the students an assistance in their repetitions.

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2. GENERAL AND SPECIAL ENGINEERING IN THE FIRST AND SECOND CŒTUS.

1. Extent of instruction.

The lecture commences with the first principles of fortification, supposes no previous knowledge, and comprises—

(*a.*) Field fortification, attack and defence of a redoubt, communication in the field, and,

(*b.*) Permanent fortification, the art of besieging, with the example of a siege that has actually taken place.

In the first cœtus it must be so far carried out that the pupil is capable of passing his *Officer's examination* according to the regulation of the 26th March 1846. In the second cœtus the general knowledge of field and permanent fortification acquired in the first is carried on in such a degree as both Artillery and Engineer officers require to form a good foundation for the particular professional study of both arms in the third cœtus.

2. Connexion of the different studies.

In the formation of the special plan of the lecture the instruction-regulations for artillery and exclusive engineering in the third cœtus are to be kept in view, so as to prepare for these subjects by the nature and the method of the instruction.

3. Principal matter of the lecture; distribution of the subjects and arrangement of time.

The principal contents of the lecture are—

A. IN THE FIRST CŒTUS.

a. *In Field Fortification.*

A correct description of the profile, the ground plan, the technical obstacles and modes of strengthening, the construction and, elementarily also, the use of field works; attack and defence of a redoubt, and the military communications in the field, as roads, fords, and bridges.

b. *In Permanent Fortification.*

Exposition of the essential principles for plan and profile; acquaintance with the parts of a bastioned fortress with the outworks; special acquaintance with a work on Vauban's first system, and its improvements by Cormontaigne. Knowledge of the characteristics of the Italian, Dutch, and French fortification, of the ideas of Rimpler and Montalembert, as well as of the latest fortifications in Prussia; lastly, a knowledge of sieges as regards a regular attack and defence. The art of construction is taught to the Engineers in the third cœtus.

B. IN THE SECOND CŒTUS.

Applied art of fortification, and, namely, attack and defence of the various sorts of field works, castrametation, permanent fortification, provisional fortification, and sieges. At their proper places, are to be introduced the precepts of military constructions which are suitable alike to the Artillerist and the Engineer, as well as the conduct of infantry and cavalry, and the duty of the Engineers in sieges.

Distribution of Time.

The first cœtus receives four, the second three hours weekly; therefore, in thirty-five weeks, the first 140, the second 105 hours. The number of hours which are to be dedicated to each portion will be indicated by the teacher in his special plan of the lectures, as it in part depends upon his experiences. All the above-named subjects must, however, be gone through within the prescribed period.

4. Method and means of instruction.

Before every principal division of the lectures, a general statement of its purport and essential principles is given; then follows a short historical exposition which is to explain the connexion, the employment, and the thence arising conditions of the subject under consideration in reference to the other parts of the art of war.

The precepts hence deducible on the form of the parts of a fortification, and on the subsisting relations of fighting, are to form the latest and principal portion of each lecture.

The lecture is to be given in detail in such a manner, that its precepts may be deduced from one another in a way suited to the powers of perception of the pupils, and their mental powers accustomed to the carrying out of principles, rather than to a

blind adherence to absolute regulations. To avoid repetition, the details of those doctrines which belong to different places are to be given only once, namely, where they are first required; and afterwards reference only made to them.

The military element, as indispensable both for the Artillerist and Engineer alike, is to be kept continually in view.

As regards the principal divisions, oral repetitions may be made from time to time for greater clearness; and, since individual and continued attention and self-reflexion alone render a well-grounded progress in the student possible, written themes, besides those prescribed, are particularly recommended. It will not be necessary to submit each individual essay to a separate correction, but the teacher may content himself each time with giving a general view of important defects in the treatment of the subject, and then reading aloud one or more of the essays that have best succeeded, and showing by their analysis how the subject could be best treated.

In both cœtus, the existing models and full sized drawings in the school, as also the models in the arsenal, and for the second cœtus more especially the models of fortresses in the model-house, are to be used.

The means employed to complete the instruction in both cœtus, are fortification drawing, practical exercise in field works, and an inspection of the fortress of Spandau.

The lectures are given without any fixed hand-book, from manuscript drafts or notes.

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3. EXCLUSIVE ENGINEERING IN THE THIRD CŒTUS.

1. Purport and extent of instruction.

The instruction in General Engineering in the first cœtus was intended to teach the Artillerist and Engineer so much of the art of fortification, of sieges, and of field works as is requisite for officers of every arm and is necessary for the students to pass their *Officer's examination.*

In the second cœtus this instruction was enlarged, and connected with its application to field and permanent fortification, to such extent as the kindred arms of the artillery and engineer corps required equally to know, that they may execute effectually their separate duties in fortification and sieges.

The instruction in Exclusive Engineering in the third cœtus is, however, intended solely for Engineers, as it teaches only professional matters which the engineer shares with no other arm of the service; while, on the other hand, the Artillerist receives a special instruction in those branches which are only necessary for the artillery officer.

2. Connexion of the different studies.

Since the lectures would receive a too great and heterogeneous extension, if to them were to be added that portion of hydraulics which the engineer officer ought to know, without being immediately connected with his military constructions, and if further, civil architecture applied to military buildings was touched on, these subjects will be taught contemporaneously in the third cœtus by special instructors, and are therefore in the lectures on Exclusive Engineering not to pass the limits of that instruction. Their respective teachers must receive reciprocally special information of each other's plan of lectures, and give mutual help by communications and inquiries where the studies might come into collision.

The teacher of the Exclusive Engineer class must learn the extent of those subjects of instruction which have been already treated in the lectures on Special Engineering in the second cœtus, and not only by inspection of the program, but by personal consultation with their respective teachers.

In more remote relation, the instruction connects itself with the earlier lectures on artillery, tactics, history of the art of war, mathematics, physics, chemistry, and the exercises in plan-drawing and surveying. The special programs of instruction of these branches of study are also to be taken notice of by the teacher, that nothing may be twice taught, and that where the use of doctrines from those studies is necessary, he may merely refer to them historically.

3. Principal division of the lectures and arrangement of time.

This instruction comprises, after an introduction, the following principal divisions.

1. The application of the rules for sieges already given to particular cases, with a general regard to the ground, more especially of irregular fortresses, shown by various remarkable sieges.

2. A theory of construction as auxiliary science in the execution of engineering works for field or permanent fortification, and in the execution of military constructions: building materials, modes of building, and the application of both for given purposes.

To this part belong—

a. A knowledge of the different building materials from the animal, vegetable, and mineral kingdoms; their production and preparation for various building purposes, and the data, so important in practice, regarding their durability and mode of employment.

b. The theory of the use and combination of these building materials for constructive purposes, and of the building of separate portions of an edifice.

c. The foundations of buildings and the means of improving the foundation bottoms.

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d. Construction of ordinary buildings, as enclosures, inclined or unloaded revetments, loopholed walls, barracks and hospitals, dwelling and guard houses, military prisons, stables, magazines, such as arsenals, waggon sheds, provision stores, bakeries, powder magazines, laboratories, communications, mines, weirs and stop-sluices, ice-breakers, &c.

e. Principles of machinery, with explanations of the forces necessary to move machines, with notice of the most common for raising and moving weights, for pumping, draining, dredging, &c.

3. The art, to apply the knowledge gained by the foregoing lectures by means of projects for certain special purposes, and under given circumstances of ground, such as his service may require of an Engineer Officer. The application of field fortification to given portions of ground is alone excepted, since the teacher of applied Fortification-drawing has this especially assigned to him, who still is only to give out his projects in unison with the teacher of Exclusive Engineering.

There belongs to this part—

a. The method of preparing plans and estimates of buildings, in the manner treated of under 2, at (*c*) and (*d*), illustrated by frequent practice in making out such plans.

b. Practice in plans for special objects and given ground, which latter is to be chosen in the neighbourhood of the fortress of Spandau.

c. Instructions generally conceived on the duties in a fortress of an Officer of Engineers, and on the practice of building in Prussian fortresses.

d. As appendix, notices on the formation and preservation of hedges, and plantations of shrubs and trees.

The time fixed for this instruction amounts in thirty five weeks, at ten hours each, to 350 hours, which, according to the importance of the different sections, may, as a general rule, be appropriated as follows :

Introduction and details of the first principal section, about	20 hours.
Theory of building, namely; the lectures on materials and their use	140 „
Lectures on constructions	80 „
Lectures on machinery	30 „
Details of the third principal section	80 „
Total	350 „

The more particular distribution of this general division of time is matter of the special lesson plan, and it only remains to be observed, that with the approval of the Director, some afternoons are to be taken for viewing the most remarkable buildings in Berlin and neighbourhood; and in conjunction with the teacher of applied Fortification-drawing, three days are to be set apart for a recognizance of the works of the fortress of Spandau, relative to the projects of fortifications mentioned under 3 at (*b*).

4. Method and means of instruction.

The two first sections of this instruction, namely, the continuation of the instruction on sieges, and the theory of construction, keep their place in the regular lectures of the school, though naturally they have an immediate applicability to practical service, and the lectures therefore ought to be made his own by the pupil by frequent exercises and detailed plans.

The projects for a given ground, on the contrary, must be worked out by the pupils in conformity with the instruction given, as much as possible independently, and as on service a young officer would do under the guidance of his superior. The drawings need not be entirely shaded, but may be partially executed by lines only, but they must be distinct and clean. Here, as in Fortification-drawing, the prescriptions of the Engineer regulation of the 25th April 1820, are to be observed, a copy of which is therefore always present in the drawing room, that they may be seen by each student. Attention is to be given also to the correctness of the scale, to correct colouring, entry on the drawing of the date when done, and of the name as well as the rank of the student, as directed by the above regulation.

In the exercises all propositions for improvements which vary from the mode of practice now in use are excluded.

The teaching auxiliaries are the books and models of the school.

4. HYDRAULIC CONSTRUCTIONS IN THE THIRD CŒTUS.

The instruction in hydraulics is to comprehend :—

1. Extent of the instruction.

1. Those general principles of hydraulic architecture which in the lectures on Exclusive Engineering in the third cœtus of the school could not be specially explained without extending them too far, and therefore were there taken for granted.

2. Such hydraulic works, as do not immediately come within the scope of military buildings, and therefore could not be included in a lecture on Exclusive Engineering, but which on account of their connexion with the profession of an Engineer Officer in general,

independently of military construction proper, ought to be known by him in their most important principles.

Since in the instruction in engineering in the third cœtus, opportunities offer for projects of fortification, with application of the theoretical principles given above (at 1), the exercise problems for the instruction in hydraulic architecture need only extend to those hydraulic works (at 2) not referring to fortification.

2. The connexion of the different studies.

The instruction is in immediate connexion with the lectures on mathematics, physics, and exclusive engineering, the last of which will be lectured on at the same time as hydraulics; the lectures on physics and that portion of mathematics which is here necessary, with the exception of hydraulics, have been already treated in the first cœtus. In arranging the plan of the lectures, and in carrying it out, the plans for those sciences must be considered, and conferences held with the teachers it may concern, to prevent the frequent repetition of the same subject.

3. Principal contents of the lecture and apportionment of the time.

The entire number of hours is seventy, two of which are given weekly, which, that they may fall in at the same time with the lectures on exclusive engineering, are thus distributed:—

	Hours.
1. Introduction and laws of the motion of water in open channels and pipes, wells, suction and forcing pumps, about	5
2. Motion of water in streams, hydrometrical measurements	3
3. Regulation of streams by dams, cuttings, &c., explanation of icefloats, and of the means to prevent their destructive power	5
4. Execution and construction of these works and of securing the banks by dikes, packing, and weirs	14
5. Historical description of the works for internal navigation, canals, sluices, towing-paths, &c	4
6. Draining and irrigation works, inundations	4
7. Harbours, moles, sands, lighthouses, roadsteads, &c.	6
8. The principles of foundations under water, with accompanying notice of the usual pile and scoop machines	12
9. The general principles of bridge building; historical relation of the most remarkable works executed of this kind	17
Total	70

To make the lecture plainer, and to exercise the student in comprehending existing hydraulic buildings, eight afternoons, at the choice of the teacher, after a previous consultation with the Director, are to be appropriated to the inspection and drawing of hydraulic constructions, at Berlin, namely the sluices and mills.

4. Method and aids to instruction.

Although this instruction embraces a large field in a very short period, it must not be extended over too many objects, but rather be confined to what is indispensable to the practical use of the engineer; the matter of these, however, to be treated fundamentally and thoroughly, and all superficiality be avoided.

The lectures are to be given from private notes, without any prescribed hand-book.

5. TACTICS.

In the First Cœtus.

1. Purport and extent of the instruction.

The Students of the first cœtus are to receive a thorough instruction in elementary tactics, and the employment of the different arms, both separately and united. The object is not merely that they may pass the *Officer's examination*, but that they may gain true general ideas on these subjects, which ought not to be strange to a well-informed officer of any arm. A frequent illustration of the lectures delivered, by examples and problems for actual ground, is particularly recommended.

2. Connexion of the different studies.

Lectures on tactics are closely connected with those on artillery, fortification, rules of the service; and in certain respects the lectures on plan-drawing and the veterinary art, as well as practical exercises in surveying.

More especially—

a. In artillery: Construction of cannon, of small arms and side arms, choice and training of horses for artillery service; organization of the artillery; regulation for the artillery on march and in camp; use of artillery in the field, as regards the specialties of its position, movement, and mode of fighting. The use of artillery in general in attack and defence, with the use of the reserve artillery in more important battles, in village skirmishes, passage of rivers and defiles, and field fortifications, belongs to the lectures on artillery, but only in the second cœtus; these subjects are therefore to be treated historically with tactics, as far as knowledge of them is required for the *Officer examination*. As a general principle, however, all the relations of detail in the constitution or the specialties of artillery are to be treated in the lectures on that science; in the tactics, on the contrary, only the more general relations which concern all the arms of the service, and where the artillery acts in union with infantry and cavalry.

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b. In Fortification; the designing and construction of field-works and all means of obstruction. The manner in which ground in general, and the given position in particular, is to be used for the throwing up field-works. Attack and defence of field-works. Complete exposition of the art of sieges.

c. Veterinary art. Natural history, physiology, and general nourishment of the horse.

d. Plan-drawing and surveying. Everything that is to be said on the general physical laws of the form of the earth's surface, and specially on a knowledge of topography and its representation.

e. Rules of the service. A knowledge of military style. Discipline in all its various branches. The internal service on detachments, convoys, and separate commands, and some historical remarks on the provisioning of an army.

3. Principal sections of the lectures and appropriation of the time.

The lectures embrace the following principal sections :—

1 Introduction. General ideas of war. War materials. Aim of war. Conduct of war. Tactics and strategy. Army organisation.

2. Organisation of the Prussian army. Raising and equipping the troops. Formation and strength. Replacing of men and materials. Supplies.

3. Special ideas of tactics. Forming, changing position, and combat. Close and open fighting; distant and near fighting. Offensive and defensive. The enemy. The ground. Characteristics of the different sorts of troops. A short sketch of the development of tactics up to their present state.

4. The proscribed tactics of the infantry, cavalry, and artillery according to the Prussian regulations.

5. Ideas on the combination of the three Arms and order of battle.

6. Influence of ground on the use of troops. Classification of ground and cognizance of the individual objects on it.

7. Occupation, attack, and defence of objects on the ground, as heights, valleys, woods, river lines, farm buildings, inhabited places, defiles, bridges, dykes.

8. Security of troops on a march. Service of advanced posts. Reconnaissances. Special duties for detachments, as escorting convoys in our own or enemy's country; foraging, surprises, ambuscades, covering of works in the field. In conclusion, some remarks on partisan warfare.

The total number of hours comprises, according to the regulation, in 35 weeks at 4 hours each, 140 hours, of which are to be employed :—

For the first and second principal sections about			-	-	-	15 hours.
„	third	„	„	-	-	-	20 „
„	fourth	„	„	-	-	-	40 „
„	fifth and sixth	„	„	-	-	-	15 „
„	seventh	„	„	-	-	-	25 „
„	eighth	„	„	-	-	-	25 „
			Total	-	-	-	140 „

4. Method and aids to instruction.

The lectures on tactics furnish the student with the positive knowledge that is necessary as a general basis; but further care is particularly taken that by the application of the problems put before the students their knowledge is not made up of mere dead knowledge, but that throughout their understandings are exercised. It is, therefore, a special duty of the teacher to frame his lectures accordingly, and as well by a development of the basis upon which the organization, the elementary tactics, and the art of war is founded, as also by very frequent exercises given to the pupils on the lectures to press towards this end.

For the solution of the tactical problems, a number of plans of ground is necessary. They are obtained on the requisition of the teacher through the Director.

It is further necessary to illustrate the use of the different troops upon the ground itself, as well for attack as defence, and to have the examples and problems given by the teachers sketched by the scholars. For such exercises four days of two or three hours each will suffice.

Of the existing hand-books, none appears perfectly qualified to serve as a basis for instruction. The filling in, therefore, of a sketch of the lectures, and of a special plan of instruction, is indispensable to give the teacher a fixed basis, and the scholars an assistance in their repetitions.

6. MATHEMATICS.

The mathematical lecture, besides its general tendency to sharpen the intellect, is to make the scholars acquainted with all those theories and laws which are indispensable to the Artillery and Engineer officer to enable him to solve with certainty and ease those problems which so often meet him in the service.

Since these problems in part require the application of rules of the higher branches of mathematics, lectures on these ought not to be wanting, and consequently the mathema-

tical instruction for at least a portion of the pupils must embrace (with few exceptions) the entire field of this science.

In order, however, that this demand be accommodated to the time at disposal and the capabilities of the students, the following rules are to be observed:—

1. The students of the first cœtus having already passed their examination for *Portépée ensign*, and the Predicate *ziemlich gut*, in their mathematical examination, being requisite for entry into the School, it is to be presumed that they enter with a good or at least sufficient preparatory knowledge. Still, as it is not to be expected that the necessary requirement in arithmetic and algebra will be possessed throughout, the first part of the instruction must be considered as the most important, and be given thoroughly and fundamentally.

2. Such portions of mathematics as are less necessary for Artillerists and Engineers (for instance, astronomy and the higher geodesy) are to be entirely omitted from the lectures.

2. Connexion of the different studies.

3. As even in such portions as fall within the scope of the lectures, there is much that cannot be exhausted, therefore all that belongs solely to speculative views, or possibly only serves to the rounding or perfecting a system, must be passed over. The instruction in mathematics stands in near and frequent connexion with the lectures on artillery, architecture, mechanics, physics, theory of surveying, and with drawing lessons, as well as with practical mensuration.

These belong specially—

a. To Artillery: architecture, mechanics; the application of all those formulas which the mathematical lectures have to deduce and to prove.

b. To Physics: the theories of dioptrics and catoptrics, which the students require to a perfect understanding of the construction of telescopes and reflecting instruments; what is necessary from aërometry and aërostatics.

c. To Drawing lessons: practical working out of the theory of perspection, and the construction of shadows.

d. To the theory of Surveying: a knowledge of all the instruments requisite for mensuration and levelling, and the principal theorems, with their application to cases occurring in mensuration.

3. Principal subjects of the lectures and appropriation of time.

The lectures on mathematics form of themselves a continuous, closely connected whole; consequently, the same teacher who gave instruction in the first cœtus is to retain his pupils in the second, so that each of the two teachers commence with the first cœtus in alternate years.

For the third cœtus there will be a selection made of those students whohave made themselves noticed in the second cœtus by distinguished ability, special application, and peculiar talent for the study of mathematics, and have thus raised hopes that they may be conducted with success into the higher branches of the science.

They form a separate division, whose number should always be small if the selection be guided strictly by the contemplated purpose. All the other students of the third cœtus form a second division, in which the entire field of what they have already been taught in mathematics is again gone over, with a view to its application; and at the end of this course some other subjects necessary to the Artillerist and Engineer are to be treated, without, however, mere scientific speculations.

For each of these divisions a separate teacher is appointed.

A. The Lectures in the First Cœtus embrace,—

I. *Arithmetic and Algebra.*

1. Algebra, with sums, differences, products, quotients, whole numbers, roots, powers with real exponents and logarithms. The qualities of fixed numbers, fractions, decimal and continued fractions. Extraction of square and cubic roots in figures and letters, practical use of logarithms.

2. Algebra, equations of the first and second degree, with one or more unknown quantities, proportions, and the higher numerical equations.

3. Arithmetical and geometrical progression, calculation of interest, theory ofcombination, binomial theory for real exponents, series for powers and logarithms and analytic trigonometry.

4. Cubic and biquadratic equations, pure equation of the *n*th degree, reciprocal equations. ($4\frac{1}{2}$ months.)

II. *Plane Geometry.*

Similarity of figures formed by straight lines, their contents. Theory of the circle; measurement of the circle and of its parts. Geometrical analysis and application of algebra to geometry. ($2\frac{1}{2}$ months.)

III. *Plane Trigonometry.*

Trigonometrical functions and their logarithms. Calculation of triangles and polygons, certain parts being given. Application to the circle. (2 months.)

APPENDIX Q.

MATHEMATICS.

B. THE LECTURES IN THE SECOND CŒTUS COMPRISE,—

I. *Geometry.*

1. Geometry of solids. Place of lines and superficies in space. Solid angles, solids, determination of their superficies and contents. Applications, with consideration of the weights of material bodies.
2. Solid trigonometry, with its application to the superficies of the earth.
3. The theories of projection and co-ordinates.
4. Conic sections. ($4\frac{1}{2}$ months.)

II. *Statics.—Geostatics and Hydrostatics.*

With application to practical cases, namely, determination of centre of gravity for ordnance and their parts, pressure upon supports, rafters, against walls, dikes and arches; stability, carrying power, strength as well as regulation and calculation of power of machines which are moved by animals. ($4\frac{1}{2}$ months.)

C. THE LECTURES IN THE FIRST SECTION OF THE THIRD CŒTUS COMPRISE,

1. Differential and integral calculation (3 months).
2. Higher geometry ($2\frac{1}{2}$ months).
3. Dynamics (mechanical), and hydraulics, with application of the determination of the strength, direction, and distribution of the recoil upon the separate portions of a piece of ordnance, of the science of projectiles, of the theory of carriages, of the rise of rockets ($3\frac{1}{2}$ months).

D. THE LECTURES IN THE SECOND DIVISION OF THE THIRD CŒTUS COMPRISE,—

1. Repetition of the most important results of the instruction in the first cœtus in a series of exercises.
2. Repetition of the theory of statics and solution of numerous problems from real life (3 months).
3. Dynamics and hydraulics without higher analysis, with applications (3 months.)

E. GENERAL APPROPRIATION OF TIME.

The number of lessons (hours) amounts, according to the prescribed plan for the first and second cœtus, to six hours, for each division of the third cœtus four hours, weekly; if the course be taken, after deducting the holidays and other interruptions, at thirty-five weeks, then there will be for the first and second cœtus, 210, and for each division of the third, 140 hours.

The number of hours to be devoted to each portion must, in the first instance, be determined by the teacher in his special lecture plan, as it in part depends upon his previous experience; at all events, all the above-named themes for the first cœtus must be treated in the stated time. Only in special cases, in the second and third cœtus, can the omission or transposition of one or the other, on reference to the higher authorities, be permitted.

4. Method and aids to instruction.

It has been already remarked that the course of mathematics should impart to the student not only that amount of positive knowledge which he requires for his immediate sphere of action and needs as incitement and guide to further study, but also should fill the important purpose of forming the mind of the students generally. This purpose will be the more certainly gained the more the teacher is enabled to render the scholar self-trusting, and in each separate study to lead to the development of a few select principles simple and easily understood, but comprising in natural and logical connexion the whole theory, so that the scholar fancies they are his own discovery, and therefore prizes them as his own. The teacher must, therefore, gradually propose a series of connected inquiries, and those naturally first on which the usual systems are based, as questions to which the students have to submit answers deduced from the above-named principles, with constant application of simple common sense. By these means the students are not only continually gaining single results, made ready to their hand by use, but what is principally desired, they acquire thereby great mental activity.

As regards instruction in the separate cœtus, the following rules are to be observed:

At the commencement in the first cœtus, the teacher should endeavour, by frequent questions to form a full and correct judgment of the previous knowledge of each student, that he may determine how he should proceed with his lecture, slower or quicker, and to what subjects generally for the entire class special notice and exercise should be devoted.

The most complete exercise of the elementary rules, forming, as it does, the indispensable basis forall future progress is in this cœtus the principal aim of the teacher.

In the second cœtus, in the application of the theory of co-ordinates to the commonest curves, no investigation of the specialties of the theory of curves is necessary, because this is reserved for later lectures, and it would here abridge the time required for subjects of nearer interest. The development of these theories must, therefore, be confined to the simplest elementary use. The study, too, of the analysis of finite numbers is to be continued only so far as the student requires for immediate application, without any intention of going

deeper into the science. On the other hand, a suitably increased time is to be given to statics and hydrostatics, because the student ought to be acquainted with them in the most complete manner.

As the first division of the third cœtus consists of but few and only the best scholars, it may be required of them to work out independently at home separate questions given by the teacher, and submit them to him for examination. The progress of the student is more surely gained and advanced, the oftener he has opportunity of personally discovering mathematical truths, or by applying them to examples to come to a clearer comprehension and use of them.

In the second division the teacher will not always be able to avoid giving a repetition of the reasons of propositions. This is necessary when he perceives from the work or expressions of the students, that the majority have not perfectly comprehended the proposition. Still the teacher will here content himself with bringing forward the most important points in the chain of deduction. The explanatory problems are solved by the teacher himself, who then sets similar ones for working out by the students at home.

For practical static problems, the teacher can use with great benefit objects often occurring in common life, and yet regarded so little: the numerous applications of the lever, of the inclined plane, &c., by Artillerists and Engineers, for their works, carriages, draught, &c., furnish sufficient material for such problems; as for instance, determination of the depth of a boat of given length and breadth when after putting into it a piece of ordnance a given height out of water is required: determination of the power requisite to overcome the resistance of a log lying in the track of a vessel; determination of the pressure of a laden beam on two or more supports with reference to the flexibility of the beam; determination of the centre of gravity in an excentric hollow shot, both theoretically with given radius and known centres, as well as more practically when the centres and the radius of its interior are unknown, as by dipping the hollow shot into quicksilver; determination of the counterpoise of a drawbridge and examination of the best position for the axle: investigation of the strength of metal and wood pipes which are to serve as water-pipes at given heights of pressure, &c.

At the same time the teacher ought not to leave unnoticed the advantages which theory can offer to practice when rightly applied, by which is in no way meant that the practical man should enter every time into a prolix and anxious calculation, but from the improvement his mind and capacities have received, he may apply readily what he has learnt to the purposes of common life.

Dynamics and hydraulics will be rather treated in a physical and historical point of view: here too the application of known professional results is the principal object.

As the limited time will not allow separate mathematical repetitions, the teacher should therefore be the more careful to make his lectures as much as possible applicatory. To ensure progress the students must, besides the usual writing out the lecture, have frequent themes given to them for work at home, and of which their own execution should be secured by proper means.

It is perfectly necessary that a hand-book should form the basis of the instruction, from which the teacher should lecture, and the students make repetitions.

The hand-books are to be proposed by the teacher to the Board of Studies, and must not be changed without permission.

These books, as well as the logarithm tables, every student must have a copy of, as he cannot do without them in the school, and may frequently require them in future life.

Models of solids, to illustrate the projection theory, are in the collection of the models of the school.

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7. PRACTICAL ARTILLERY EXERCISES.

1. Purport and extent of instruction.

The practical artillery exercises are intended, in the first place, to furnish the students with a sight of that portion of the material of the artillery which they have had no previous opportunity of knowing, and of which the knowledge is indispensable for a complete understanding of the theoretical lecture. The exercises should follow the lecture as immediately as possible, and occur therefore during the continuance of the theoretical course.

The students are besides to become acquainted with the methods of execution of the most important artillery duties, in an extent compatible with their position, and the time at their disposition. For this portion of the exercises, the months of July, August, and September are to be preferred.

In the major part of these exercises, the Engineer students take part, so as to gain a knowledge of such parts of the artillery service as seem to be of the greatest importance to them.

The artillery exercises separate into numerous subdivisions, of which the following may be particularly remarked:—

APPENDIX Q.

PRACTICAL ARTILLERY EXERCISES.

2. Objects and division of the exercises and appropriation of time.

I. EXERCISES OF THE FIRST CŒTUS.

A. *Visits.*

The visits happen, as already noted, at the period of the theoretical instruction. The students are to be divided into as many sections as is necessary, that each may gain the desired information. There belong to this part—

a. Visiting the foundry and the boring machine. All the students of the first cœtus are to be taken by the Artillery teacher of this cœtus, on two afternoons, to the foundry, and to the new boring machine.

They will see the general construction of the foundry and the boring machine, and, in case such work is going on, the moulding, boring, and turning, and receive the explanations necessary.

b. Examination of ordnance, gun carriages, and ammunition waggons.

Those in the Arsenal, as well as the exercising pieces of the Regiment of Artillery of the Guard, are to be used for this purpose, to exhibit the construction of ordnance both in the Prussian and foreign artilleries, and also those of an earlier date, from the specimens kept there. In the same way as has been remarked for the ordnance, the gun carriages and equipages of the Guard Artillery Regiment in store will offer opportunity for a more exact scrutiny of these carriages, limbers, and waggons. For these visits four afternoons are to be taken.

c. Visit to the workshops of the artillery :—

The students will, in two afternoons, gain there a knowledge of the following objects :

1. The mode of work in general.
2. Processes in the manufacture of the most important objects of artillery material, as axles, wheels, carriages, mountings, sponges, harness, ropes, &c.
3. The raw material (wood, iron, leather).
4. Objects furnished to field, siege, and fortress artillery.

d. Visit to the small-arms factory and powder mills in Spandau :—

The scholars of the first cœtus will be conducted into both manufactories, to obtain a general insight into the various works.

In order that the work of the manufactories may receive no interruption, the teacher of the first cœtus is to communicate beforehand with their respective Superintendents, and take the students in suitable small parties, and before entering the powder manufactory to insist, most carefully, on all the proper precautions being observed.

These visits are to take place during the theoretical course on the same day as is fixed for the first cœtus to visit the fortress of Spandau to study its fortifications; and, therefore, an agreement should be made between the teacher of Artillery and the teacher of General Engineering.

e. Visit to the armoury at the Arsenal :—

The students are to be conducted on an afternoon to the armoury of the Arsenal, where the superintendent will explain to them the peculiarities of match and wheel locks, with the most remarkable projects for loading at the breech, and with the form of small arms amongst other nations.

B. *Exercises.*

a. Examination of small arms :—

The students are to be taken by their teacher to the musket manufactory, where they will be shown the mode of proof of small arms in general, and with reference to the theoretical lecture then in progress.

Each student then receives a faulty musket, with direction to examine and note its defects. The teacher revises and corrects these notes.

b. The management of machines :

In the presence of the students the management of various machines, &c., as well as the repair of damaged carriages, will be undertaken. According to the means at disposal, such exercises will be selected as are most instructive, in exhibiting arrangement, strength, and care in their application.

The students will be permitted to lend a hand only in such cases as it is foreseen that their strength will be sufficient. For all other purposes where strength is necessary, workmen must be employed.

II. EXERCISES IN THE SECOND CŒTUS.

When the teacher judges proper, some of the previous visits are repeated on the afternoons disposable during the theoretical course.

A. *Marking out and tracing Batteries.*

The students undertake these exercises under inspection of their teacher of Artillery on two days in the last three months of the course.

The teacher instructs them then how to ascertain the prolongation of the enemy's lines, and the mode of determining the line of fire of the first embrasure of the different

batteries, as well as the other points to be marked out, both with the use of the usual instruments, and with simple measurement by pacing, and laying down right angles by the eye.

A complete construction of a battery is not possible on account of the shortness of time, paucity of means, and strength of the students. The exercise, therefore, is confined to an explanation of the formation of the material and tool depôts; to marking out and tracing horizontal and sunk batteries on even, irregular, and sloping ground, and to the construction of the powder magazine.

B. *Practical Exemplification of the Rules for placing Ordnance according to the Ground.*

These exercises are to be carried out on two afternoons by all the students, under the inspection of their Artillery teacher.

They have only reference to the ground, and leave out of consideration all tactical considerations. This object may be fully attained even without guns, and the necessary instruction may be given without them, as it would not be easy to form all the batteries in the desired number.

The teacher chooses the ground, explains it by means of a plan to the students, and goes with them to the place. He divides them into various sections, and lets each select positions for from two to eight pieces, both for attack and defence with different kinds of ordnance, giving only generally the direction and distance at which the enemy is operating.

Each position is inspected by the teacher, and the views and reasons for it received and discussed as regards effect, mode of firing, and covering and free movement, and where it is necessary, improved; and at the same time the requisite precautions taken for the limbers and waggons.

C. *Drawings of Ordnance Carriages and Waggons.*

These exercises are to be undertaken by the Artillerists of the second cœtus, under inspection of the teacher of Artillery-drawing, on twelve afternoons in June.

The drawing of a piece of ordnance is to be clearly distinguished from the examination of it. For the first, taking the necessary measures is alone necessary, but not their comparison with given models.

The teacher will order these exercises, so that the students learn principally—

1. What scale they ought to take for a given object, so as to execute a drawing with the precision necessary for being afterwards worked from.
2. With what instruments and method of procedure they may most easily obtain their end.
3. How notices of improvements are to be taken and arranged.
4. How the rough draft is to be jotted down.

It must be here particularly remarked that our guns, carriages, &c. have no mathematically exact forms, and that therefore the number of measures to be taken must be often multiplied to have a true figure of the body.

A fair drawing from these measures in the above period is so much the less possible, as the number of objects is as much as possible multiplied. It is fully sufficient, however, for the purpose of this exercise, that the students, learn to take complete and useful rough drafts.

On their entrance into the third cœtus, the complete drawings from these rough drafts take place.

In his selection of objects to be drawn, the teacher must, in having regard to variety, take care that the drawings by too great difficulty do not exceed the time and power of the students, nor by too great simplicity cease to be instructive.

Ordnance carriages, limbers, waggons, and the machines required in artillery, are the most suitable for choice, and are easiest obtainable in the Arsenal.

The students must be divided into sub-sections, of at most three to four persons, and to each a separate task given.

The teacher is to be present at the drawings to see to their proper execution, and has delivered to him the notices and the rough sketches to amend any errors that may be in them.

The relative section of the second edition of Burg's "*Drawing of Artillery Material*" is to be taken as the basis for these exercises. In addition to them, the students receive guidance and suitable instruction in drawing artillery objects offhand by the eye, without the use of instruments. The first two days are to be chosen for this, and the students by this use of offhand drawing receive at the same time a useful preparation for the drawings subsequently required to be taken by the aid of instruments.

D. *Exercises necessary in regard to Sieges—*

Are to be conducted by the teacher of Artillery and Special Engineering jointly, and are given more in detail under *exercises in fortification.*

APPENDIX Q.

PRACTICAL ARTILLERY EXERCISES.

III. EXERCISES IN COMMON OF THE FIRST AND SECOND CŒTUS.

A. *Proof of Powder.*

This exercise is to be conducted by all the students of the first and second cœtus at the time of the gun practice, and comprises—

1. Firing different sorts of powder from the proof mortar.
2. Firing different sorts of powder purposely brought into an abnormal state.
3. Instruction in weighing and measuring the powder.

B. *Artillery Practice.*

All the students of the second and third cœtus take part in the practice under the inspection of the two teachers of Artillery, for which fourteen days in August and September are fixed. If possible, it is to be undertaken in the morning, and only when the practice-ground is otherwise occupied is it to be deferred till the afternoons.

The practice comprises—

1. The necessary preparation for firing; namely, laying down the platform, marking the range, fixing the targets, preparing the lists to note the shots.

2. Firing from different kinds of ordnance and with different projectiles.

3. Instruction of the students in the service of the guns; selection of the charge and direction under given circumstances, and their correction; effects of distance; noting and jotting down the shots and the time of flight; calculation of the length of fuse, of ranges and averages from the different data, and remarks on the effects sought.

4. Burning a portion of prepared laboratory materials for observation of its action and effect.

The following are to be objects of practice:—

a. Rounds of six, twelve, and twenty-four lbs. shot and shell out of the the short 24-pounders, to note—

aa. The grazes, distances, and deviations at different elevations, and as regards ricochet fire.

bb. Probability of hitting upright targets at various distances.

cc. As regards dismounting.

dd. As regards firing against heads of saps.

b. Seven, ten and twenty-five lb. shells, carcases, and light balls, to note—

aa. The grazes, distances, and deviations at different elevations and charges, also as regards ricochet firing.

bb. The probability of hitting upright targets at various distances.

c. Shells, carcases, and light balls from mortars, to note—

aa. The probability of hitting upright targets at different distances.

bb. The calculation of the charge or elevation when one of these elements and the distance are given, or *vice versâ*.

cc. Calculation of lengths of fuze for given distances.

d. Throwing hand grenades, stones, 1-pound case shot, and 3-pound balls at various distances for comparison of the effects.

e. Firing from the hand and stock-mortars at differing distances.

f. Case shot from 6 or 12 pounders, also from short or long 24-pounders and 7 and 50 pound howitzers at different distances against planks, and both with case shot, and grape shot, for observing the effect:

aa. Of different charges.

bb. Of different weights of the entire case.

cc. Of the weight and size of balls used.

dd. There is also to be observed the scattering, the number of hits and wide balls, and determination of the best line.

g. Shrapnel shells from field-pieces against planking.

5. The number of the before-named rounds is not to be too great, partly not to increase expense, partly in regard to time, since the practice is intended for instruction, and therefore not to be hurried. Still for shot, shell, and grape shot, ten rounds is the *minimum* if a result is to be drawn; for the small mortar five rounds are sufficient.

Notwithstanding this limit, it will not be possible to take the practice all in one year. It seems, therefore, expedient to divide the whole into two portions, so that the most important practice happens indeed in each year, generally however, in one year the practice is to take place with field-pieces, in the following year with siege-pieces, so that the student who is present once in the first year and once in the second can complete the necessary course.

The teachers have, therefore, to determine, in the proposed plans for these exercises, the sort and number of rounds they judge necessary for the following year.

C. *Practice in the Laboratory.*

1. Object and extent of instruction.

As the students of the Artillery, by the present regulations of their education in the regiments, have not sufficient opportunity to learn the service of the laboratory perfectly, particular attention must be paid to this work in the school.

The students of the Engineer Corps also take part in it, in the second cœtus, not to become perfect proficients in the different operations, but so as to gain a general knowledge of ammunition, matches, and compositions, and the duties of the laboratory.

All the students of the first, and the Artillery students of the second cœtus are therefore to be occupied by their teachers for twelve afternoons in the laboratory.

For the superintendence, so necessary in these works, and for variety of practice, the fireworkers employed as assistant teachers in the school, and others from the Proof Department of the artillery, and also five or six Artillery Officers of the third cœtus, are to be present at this practice, so that each of these students is present twice or thrice on the average.

The work embraces, first, the preparation of ammunition for the Artillery practice, &c.

But as this would not suffice for the complete instruction of such a large number of students, it must receive an extension calculated for this purpose, and embrace not only the separate preparations, but also a large quantity of ammunition; which, as not required for the school, is therefore sent to the depôt.

The following work is to be preferred :—

Pounding of saltpetre, grinding meal powder, pounding sulphur and charcoal, boiling paste, making mastic, composition, quick-match, fuses, tubes, portfires, carcass composition, touchpaper, case and grape shot, loading shells for bursting, discharging empty shells in which a fuse only has been driven; carcasses, fire-balls, and light balls; infantry; cavalry, buck-shot, and percussion cartridges; ball, canister, howitzer, and paper cartridges. Fanal, signal rockets, pitch compounds, powder bags, and stink pots. The teacher is to make a careful distribution of the students, (allowing for such as have missed any days by illness,) to be satisfied that each Artillerist has made every article in the laboratory, if possible, or at least has carefully witnessed its preparation.

IV. Exercises in the Third Cœtus.

All the exercises of this cœtus take place during the period of the theoretical course.

A. *Visit to the Workshops.*

The student will have to learn the mode of proceeding, the construction, and the use of the machines employed. Examination and storing of the most important raw materials.

B. *Visit to the Iron Foundry.*

All the students of the third cœtus are to be divided into two sections, and each section to be conducted on an afternoon under the care of the teacher of Artillery concerned to the Royal Iron Foundry.

They will see there the moulding, casting, and cleaning of case shot, cannon balls, and shells.

They will also have explained to them the construction of reverberatory and cupola furnaces, of steam engines, and of turning lathes and planing benches.

C. *Visit to the Foundry and Boring Machine.*

The students of the third cœtus are to be present at the actual manufacture of cannon, their moulding, casting, and boring. But as the circumscribed room and other considerations will not allow all the students to be present at one time, different divisions are to be formed, to visit the foundry and boring house on different days. The teacher concerned will, therefore, make the necessary inquiries as to the time when the above works are going on, and arrange the visits by communication with the Director.

The casting and preparation of iron ordnance require particular attention. On this, too, the teacher has to obtain information, and proceed as above.

D. *Examination of Iron Ammunition.*

The Artillery Officers of the third cœtus take these exercises in hand on two afternoons, under care of the Artillery teacher in the same cœtus.

The purport of it is not so much a thorough instruction in this manufacture, as a completion of the theoretical lectures on the mode of conducting the processes by means of personal inspection and handling of the instruments. The teacher will pay particular attention to the errors that may occur in the measurements, &c.

E. *Examination of Cannon.*

This exercise is to be undertaken by the Artillery Officers of the third cœtus, under the inspection of their Artillery teacher, in six afternoons. The object of it is exactly the same as of the foregoing.

The exercise must commence with directions for proving the instruments, when the teacher will show the mode of their manipulation.

As the use of such instruments only can be reckoned on as the school, the depôt, and the Artillery Proof Department possess, only three sections of the students can work each day simultaneously; the section consisting, at the utmost, of six persons, if individual handling of them is presumed necessary.

APPENDIX Q.

PRACTICAL ARTILLERY EXERCISES.

The teacher must therefore divide the students into sub-sections, and make such arrangement that each student, if possible, personally work every part of the exercise, or at least have a perfect sight of it.

That portion of the students which cannot be immediately occupied on each exercise day, put their tables of dimensions in the order and forms required by the regulations.

F. *Examination of the Gun Carriages and Waggons.*

The exercise is to be conducted by the Artillery Officers of the third cœtus, exactly as the foregoing, in five afternoons.

G. *Practical Exposition of the Rules for the placing of Guns according to given Tactical Relations.*

These exercises are to be performed by the Artillery students of the third cœtus, under the direction of their teacher of Artillery, on four afternoons.

The teacher makes known the ground by means of a plan; he then directs reconnaissances to be made, and receives the reports.

He selects a tactical problem, the nature of which offers opportunity to remark both on the placing of guns of different calibres, and also the reserve artillery at the decisive moment of a battle, as well as the more minute details of placing single divisions and guns, and the limbers, riding horses and waggons.

Before he solves himself the problem completely, he gathers the opinions of the students in respect to single portions, and if necessary sets them right.

The principles to be followed refer so specially to the ground, that the object of illustrating the instructions can be attained without guns. The teacher may therefore content himself with marking by flags the situation of single guns and batteries, by which the advantage is obtained of an easier use of the ground.

H. *Exercises at Spandau in reference to a Siege.*

These exercises are to be conducted by the teacher of Artillery, in unison with analogous regulations of the teacher of Engineering, and are more particularly mentioned in the practical exercises of fortification.

3. Method and means of execution.

The limits of time and means render it impossible to gain for the above-named exercises that extent by which the full acquirement of the necessary mechanical readiness could be ensured. It is sufficient if the student has made a perfect personal examination and performed as much manipulation as circumstances permit.

The separate practical exercises can only be made after the termination of the theoretical treatment of the subject. This rule is necessary, partly because this practice is only a continuance and completion of the lecture, partly because the shortness of time restricts the exercises considerably, and therefore the days devoted to them cannot be applied to theoretical explanations, which will be more profitably given in the lectures.

Where the nature of the exercises permits, the officers and elder *portépée ensigns* will take the superintendence, that having formerly learnt the execution, they may now make themselves acquainted with the duties of ordering and inspection.

The number of students engaged at one time in an exercise ought not to be so large that a portion of it remain unoccupied or not under the complete inspection of the teacher. The disturbances that occur too easily in such cases, being most injurious, must be most carefully avoided. The teacher will make the division above stated, and take all necessary measures for obtaining the requisite control.

If, at any of the exercises, danger can arise to the students, the teacher is previously to instruct them specially in what is to be observed for the safety of the workmen; after that, the superintendence of the students must be conducted with increased care, and any departure from the given orders visited with redoubled severity.

The determination of the days for these exercises rests with the director, after consulting the teachers. Should unexpected hindrances prevent the carrying out an exercise, the teacher may determine concerning it, but must consult with the Direction as to the fetching it up on another disposable day.

The necessary workmen will be demanded by the Direction from the respective services, of which the teacher will give to the Direction due previous notice.

The guns necessary for practice are to be lent by the Artillery Regiment of the Guard and the Artillery Depôt; all the other instruments, equipments, &c. are borrowed from the Depôt. All materials are received by order of the war department or by purchase. It is therefore the business of the senior of the two Artillery teachers, in his yearly demand for the practice, to state the full requirement of tools and materials, that the Direction may take timely measures for their supply.

8. PRACTICAL EXERCISES IN FORTIFICATION.

Practical exercises in fortification stand in immediate relation to the lectures on fortification, sieges, and field engineering. They complete, as far as possible under given circumstances, the theoretical lectures by personal view; they also offer the students

opportunity for solving fitly chosen problems, to apply what has been learnt, and to prepare by reflection for practical service.

The exercises are to be conducted in each cœtus by the teachers who lecture on Engineering. The presence of the Artillery teacher is elsewhere separately noted.

A. THE EXERCISES COMPRISE—

a. *For the First Cœtus.*

3. Object and division of the exercises, as well as appropriation of the time.

1. In unison with the teacher of Artillery and of General Engineering, the examination of the of fortress Spandau, to make clear to the students the combination of the details of a complete fortress from an actual example.

2. Examination of the models of fortresses and their details in the Arsenal, to make clear the principles of a siege.

3. Visiting the exercising-ground of the Engineer division of the guard in all its details.

4. Marking out, tracing, profiling, calculation of the cubic measurements, of the time for building, of the number of workmen, and of the garrison for given fortifications on ground near Berlin.

5. Being present at the exercises of the Engineer division of the guard in sapping, mining, building redoubts, laying bridges, and their instructions.

b. *For the Second Cœtus.*

1. Examining the models in the model house, partly to illustrate the systems taught, partly to show the influence of ground on the situation, form, and contrivance of the works ; and again to explain by the aid of the necessary notices of the sieges of these fortresses the choice of the fronts of attack, and other matters relating to sieges.

2. Problems on the ground for sieges, such as may happen, to a subaltern officer, as simple as possible, but to be solved clearly and exactly.

These exercises refer principally to the marking out of parallels, zig-zags, and saps, as well as marking out and tracing siege batteries. They are to be undertaken under the united direction of the teachers of Special Engineering and of Artillery on the exercise ground of the Guard Engineer division.

8. Problems on field fortification, not too comprehensively drawn out, but of which the solution should be the more complete. Here belong, *e.g.*, the fortifying of a house a farmstead, a bridge, or other defile, covering of an advanced post, &c. &c.

c. *For the Third Cœtus.*

1. For the Artillerists :—Exercises in reconnaissances of fortresses. Fixing the points for laying down batteries of attack. Statements of the arming of detached works against *coups de main* and formal attacks. Sketches of instructions for subordinates in particular cases. Construction of ammunition and other depôts in and before a fortress. Under the guidance of the Artillery teacher of the third cœtus, with regard to the analogous regulations of the teacher of Exclusive Engineering.

2. For Engineers :—*a.* Reconnaissance of Spandau in reference to projects in permanent and field fortification, as well as military architecture and hydraulic works, under the guidance of the teacher of Exclusive Engineering, with the assistance of the teacher of Fortification-drawing.

b. In conjunction with the Artillerists, reconnaissance of Spandau for fixing a front of attack, securing its investment by field fortification adapted to the ground. Placing the depôts of material. Marking out the first parallel, with its communications, as well as the subsequent works of attack. Measures of the defenders, special discussion on arming the works on the spot. Under the guidance of the teacher of Exclusive Engineering, having regard to the analogous regulations of the Artillery teacher in the third cœtus.

B. FIXING AND APPORTIONING THE TIME.

a. *For the First Cœtus :*

1. The visits prescribed in 1 and 2 for this cœtus are to be made in spring, whilst the theoretical course is going on, and for them are fixed - - - - - - - - - - -	2 days.
2. The further exercises under 3, 4, and 5 are to be taken in the summer months ; to them are allotted, for the visit at 3 - - - -	1 „
To the exercises, at 4 - - - - - - - - - -	5 „
To ditto at 5 - - - - - - - - -	6 „
Total - -	14 „

APPENDIX Q.

PRACTICAL EXERCISES IN FORTIFICATION.

b. *For the Second Cœtus:*

The exercises under 1, 2, 3 for this cœtus, are to be held in the summer, and are thus regulated:—

For the visit at 1	2	days.
To the exercises at 2	2	„
To ditto at 3	8	„
Total	12	„

c. *For the Third Cœtus:*

The exercises ordered for this class are to take place only in Spring, whilst the theoretical instruction is going on, and for it are fixed:—

1. For exercises by the Engineers alone	2	days.
2. For those jointly by Engineers and Artillerists	3	„
Total	5	„

The days of the calendar for these exercises are to be proposed by the teachers when delivering in their annual sketch of exercises, and their propositions will be laid by the Direction before the authorities for their approval.

4. Method and modes of execution.

To engage the pupils to work they are to be divided for the visits and exercises into suitable sections. Each section receives its problem from the teacher, who also nominates the president of the section. This president distributes the sub-sections among the other students, and sees that the work to be written and drawn is finished in the required time, signed by the author, and is delivered by him to the teacher. Great care is to be taken that single students do not remain unoccupied; the disturbances thence only too likely to arise are always injurious to the instruction and the discipline. In giving out problems, their principal conditions only are to be designated by the teacher, and the development left entirely to the student, or with little aid from the teacher, in order that the student may gain early that confidence and independence necessary to the soldier in carrying out matters committed to his charge.

In the exercises the workmen demanded for marking out, are to be limited as much as possible, as the students must perform the greatest part of the work themselves. The number indispensably necessary will be demanded in time by the teacher from the Guard Engineer Division through the Direction.

The necessary material, if the Guard Engineer Division cannot furnish it as a loan, may be purchased at the charge of the school.

APPENDIX R.

ACCOUNT OF THE WAR OR STAFF SCHOOL, AT BERLIN.

COMMUNICATED BY GENERAL VON HOPENER.

ORGANIZATION OF THE ROYAL WAR SCHOOL OF PRUSSIA.

1. *Object of the Institution.*

Object. The War School (*Kriegs-Schule*) is intended to receive Officers of all Arms, who during three years of active service have given proof of ability and of particular capacity. They find there the means for acquiring the knowledge requisite for the higher ranks of the service, for the duties of Officers of the Staff, and for all other appointments which demand military and scientific studies of a higher and more general character than the common ones.

2. *General Plan.*

General Plan. The course of study is for three years, and is divided amongst three classes. The courses begin on the 1st of October, and continue to the 1st of July. The number of Officers who can be received is 120, neither room nor means of instruction sufficing for more. The three months of vacation in the summer are employed by the pupils in learning the service of those arms of the profession to which they do not belong.

3 *Staff of the School.*

4.

The Special Direction consists,—
(*a*) Of the Military Direction.
(*b*) Of the Direction of Studies.

5.

The Military Direction consists of a Director, a Field Officer connected with the Direction as Inspector, and an Adjutant, who directs the accounts of the Institution.

6.

The Military Director is supreme, both over the Military Officers who are members of Direction, and of the Military Officers who are studying in the School. The Police, the Discipline, and all the administration of the Institution are under his control. All the subordinate officers in the house are under his orders. The Field Officer attached to to him is charged to look carefully to the discipline and to the due attendance at the lectures. The Adjutant directs the correspondence and accounts of the establishment. The whole of the Staff and the Military Directors are lodged in the School.

7.

Staff of the School. The Direction of Studies is in the hands of three Field Officers of literary and scientific attainments, and of two other persons, civilians of Berlin, of high literary reputation. Its President is the Senior Officer, who is generally also the Military Director. It has also a Secretary attached to it.

8.

The Direction or Board of Studies is exclusively entrusted with the care of everything affecting the teaching of the Institution, and its members are bound to be frequently present at the lectures. It has also under its inspection all the means and objects required for teaching, such as the library, the collection of maps and models, the collections for physical science, and the laboratory.

9.

The Director of Studies selects the Professors of the Institution, recommends them to the superior authorities, and in case of their appointment gives them their instructions.

10.

At the beginning of each course the Direction fixes the plan of the lectures, and if any alterations in them are required, proposes them to the superior authorities for their sanction.

11.

The Direction of Studies regulates the Examinations which the Officers who are candidates for admission into the School are to undergo. With this view it draws up a

APPENDIX R.

Prussian Staff School.

certain number of subjects and questions suited for the purpose, which it sends, in the spring of each year, to the Chiefs of the Staff of the different Corps d'Armée, in whose presence the candidates do their work. Those of the candidates whose work is satisfactory are entered at once in the School.

12.

In order to take account of the progress of the Students, the Board of Studies makes them pass an examination in writing at the end of every three months; makes a revision of the judgment of the Professors upon the papers; and, conjointly with the Military Board of Direction, gives certificates at the end of the triennial course to the Officers who have gone through it completely. In these studies it is the part of the Board of Studies to give a judgment on the scientific merit, and that of the Military Board to judge the moral conduct of the Officers.

13.

The two Boards make a Report yearly on the progress and the conduct of the Officers of the School. This Report is submitted to the King by the Minister of War. Particular mention is made of those Officers who by extraordinary success have deserved His Majesty's favour.

14. *Subjects of Instruction.*

Instruction.

Attendance on the different courses is partly obligatory, partly compulsory, with this restriction, however, that every Student must attend twenty lectures a week, given before 12 o'clock, including the obligatory courses. These last are those of the purely military sciences, and for the first class those of mathematics. As it is impossible for most of the pupils to give sufficient attention to all the courses to be examined in them at the end of each three months, they are allowed to select those of the courses which they may choose to follow. But this choice once made must be adhered to.

15.

The Instruction is divided into Theoretical Courses and Practical Exercises.

16.

The Theoretical Courses comprehend all the subjects which come within the object of the Institution. They are the following:—

1. Mathematics, a course of three years, six lectures a week, half employed in statement of the theory, half in the practical application.
2. The Higher Geodesy, in the third class, three lectures a week.
3. Physical Geography, in the first class, two lectures a week.
4. General Geography, in the first class, four lectures a week.
5. Special Geography, particularly that of the probable theatres of War for Prussia, in the second class, four lectures a week.
6. Universal History, in the first and second class, four lectures a week in each.
7. General History of Literature, in the third class, four lectures a week.
8. Logic, in the second class, four lectures a week.
9. Physical Science, in the second class, four lectures a week.
10. Chemistry, in the third class, four lectures a week.
11. Physiology of the Horse, in the second class, two lectures a week.
12. Tactics, in the first and second classes, four lectures a week in each.
13. Artillery, in the first class, three lectures a week.
14. Fortification, a course of three years in the three classes. In the first class, Field Fortification; in the second, Permanent Fortification; in the third, the Conduct of Sieges; two lectures a week in each class.
15. Military Administration, in the first class, two lectures a week.
16. Military History, in the third class, seven lectures a week.
17. Duties of the Staff, in the third class, three lectures a week.
18. Military Law, in the third class, one lecture a week.

All these lectures are given in the morning, between eight and one o'clock.

19. The French Language, a course of three years in different classes; into each of which the pupils enter according to the knowledge they possess of the language; six lectures a week for each class.
20. The Russian Language, four lectures a week.

The above two courses are in the afternoon.

The Practical Work is done after the end of the courses of the second and third classes. They consist in making the Officers draw plans for military objects, make sketches of ground.

These exercises are completed by a journey of fifteen days under the conduct of an Officer of the Staff, in order to teach the service of an Officer of the Staff in the country.

17. *Instruments of Teaching.*

1. A Library for the use of Professors and Students, and a Collection of Maps and Plans, all under the charge of a Librarian living within the School.
2. A Collection of Models for the Courses of Artillery and Fortification, under the care of a Commissary of the school.

3. A Cabinet of Physical Science, under the direction of a Professor lodged in the house.

4. A Laboratory and Chemical Apparatus, under the direction of a Professor of Chemistry.

There are no manuals specially used for the instruction.

For the Courses of Geography and of the History of War, the Direction furnishes the pupils with the plans and maps required, as far as the means of the Institution allow it, or it procures them at moderate prices, to be repaid by instalments.

18. *Regulations for the Professors.*

Professors.

The Officers acting as Professors in the School are Officers of mature age and high education, chosen from the garrison of Berlin. The teacher of the Duties of the Staff must always belong to this corps. They are appointed to their work in the School for an indefinite time, without prejudice to their other duties.

19.

The Civil Professors are generally chosen from those of the Royal University at Berlin.

20.

With regard to discipline, all the Professors are subject to the Board of Military Direction; with regard to teaching, to the Board of Direction of Studies.

21.

Every Professor is bound upon entering on his functions to lay before the Board of Direction of Studies a program stating the bearing, the successive subjects, and the arrangement of his Course. This program must be approved by the Direction.

22.

The payment of Professors is fixed according to the number of their weekly lectures. It is less for the Professors of Language, as they require less time to prepare their lectures.

23. *Regulations touching the Students.*

Students.

The Students of the School are under the immediate authority of the Military Direction; but they are ordered to look upon the Professors, whilst engaged in their duties, as their superiors, so that offences against them are subject to military law.

24.

Permission to follow the Courses of the School involves for every Officer the obligation to serve two years in the Army for every year passed in the School.

25.

Although the complete Course is for three years, Officers do not always continue it for more than one year. At the end of the year those only are allowed to return who have shown themselves deserving of this favour. Students lose the right of continuing their studies who neglect their lectures, or show indifference and a want of interest in their work, who come often too late, avoid the duties imposed upon them, or endeavour to escape their examinations. Any ill conduct, or even want of capacity to continue a sedentary life, or any inaptitude for the branches of the service distinct from their own, shown in the part they take in them during the summer, are also disqualifications.

26.

At the end of every annual Course the Boards of Military Direction and of Studies meet together, to fix, in accordance with the preceding paragraph, the list of Officers who have gained the right of returning to the School.

27.

At the beginning of the Courses the Students must give notice as to which of the voluntary Courses they mean to attend. After this notice, such Courses are regarded as obligatory, and no dispensation from them can be obtained.

28.

At the end of the Course of each year, the Officers are allowed to ascertain the judgment given upon their work in the three-monthly examination by the Professors.

29.

Other points relative to the Students are the subject of special regulations.

30.

An Employé of the house, called the Commissary, is charged with the surveillance of the buildings of the School and the furniture belonging to it. He has to look after its security, order, and cleanliness. He must take an inventory of all things belonging to the house.

APPENDIX S.

War or Staff School, Berlin.

Table of the Distribution of Time for the Course from October 1, 1855, to July 1, 1856.

FIRST CLASS.

	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
8— 9	Artillery.	Physical Geography.	Military Administration.	Tactics.	Physical Geography.	Artillery.
9—10	Ancient History and History of the Middle Ages.	Field Fortification.	Military Administration.	Tactics.	Ancient History and History of the Middle Ages.	Artillery.
10—11	Ancient History and History of the Middle Ages.	Field Fortification.	Universal Geography.	Universal Geography.	Ancient History and History of the Middle Ages.	Tactics.
11—12	Mathematics.	Mathematics.	Mathematics.	Mathematics.	Mathematics.	Tactics.
12— 1	Mathematics.	Universal Geography.	Mathematics.	Mathematics.	Mathematics.	Universal Geography.

The hours of application of Mathematics are, for the First Division, on Mondays 12 to 1, and Thursdays 11 to 1; and for the Second Division, on Wednesdays 11 to 1, and Fridays 12 to 1.

SECOND CLASS.

8— 9	Natural Philosophy.	Modern History.	H	Natural Philosophy.		Permanent Fortification.
9—10	Natural Philosophy.	Modern History.	History of the Art of War.	Natural Philosophy.	Modern History.	Permanent Eortification.
10—11	Logic.	History of the Art of War.	Logic.	Logic.	Modern History.	History of the Art of War.
11—12	Tactics.	Mathematics.	Mathematics.	Mathematics.	Tactics.	Hippology.
12— 1	Tactics.	Mathematics.	Mathematics.	Mathematics.	Tactics.	Hippology.

The Practical Exercises on the Field will be conducted in Five Divisions, both in the neighbourhood of Berlin and at a distance from it; the latter for the purpose of surveying high ground after the conclusion of the Lectures. The hours for application of Mathematics are on Tuesdays, Wednesdays, and Thursdays, from 12 to 1.

THIRD CLASS.

8— 9	Duties of the Staff.	Duties of the Staff.	Mathematics.	Literary History.	Sieges.	Duties of the Staff.
9—10	Military Law.	Literary History.	Mathematics.	Literary History.	Sieges.	Military History.
10—11	Military History.	Literary History.	Military History.	Military History.	Military History.	Military History.
11—12	Mathematics.	Chemistry.	Military History.	Mathematics.	Chemistry.	Higher Geodesy.
12— 1	Mathematics.	Chemistry.	Higher Geodesy.	Mathematics.	Chemistry.	Higher Geodesy.

The Exercises in Sketching and the Practical Military Exercises. The hours of application for Mathematics are on Mondays and Thursdays from 12 to 1, and Wednesdays from 9 to 10. French instruction, First Division Mondays, Wednesdays, and Fridays, from 4 to 6; Second Division, Tuesdays and Thursdays from 4 to 6, and Fridays from 6 to 8; Third Division, Mondays and Wednesdays from 6 to 8. Instruction in Russian, Tuesdays and Fridays from 4 to 6.

APPENDIX T.

VON SCHARNHORST'S DESIGN FOR THE WAR SCHOOL.

School divided into two classes.

Scharnhorst's chief School (the *Kriegs-Schule*) was intended to have Two Classes :—

1. In the First Class, the Elementary Sciences are to be taught ; such as a *Portepée-fähnrich* requires, in order to be made an Officer.
2. In the Second Class, the higher Sciences are to be taught, such as an Officer of Artillery, Engineers, or the other arms requires who wishes to embrace in his studies the whole compass of Military Science.

Course for 1st Class.

The Course of the *First Class* is to last three-quarters of a year; that of the Second, three years. But in the latter, only nine months of each year are to be given to study.

The Sciences to be taught in the First Class are :—

1. Geography, but not in too minute detail.
2. History, also not in too great detail.
3. Pure Mathematics, Euclid, and as far as Trigonometry.
4. The German language, chiefly in practising letters, essays, &c.
5. The French language.
6. Fortification and Entrenchments.
7. Drawing.

   Besides the common Drawing, lectures on—

   (*a.*) Surveying.

   (*b.*) Mensuration by the eye.

   (*c.*) Practice in firing with small arms, with guns, howitzers, and mortars.

Course for 2nd. Class.

In the Second Class, the subjects taught comprise the highest Course of Mathematical and Military Science. No one can enter this class without possessing the acquirements of the First Class.

1. A Course of Pure Mathematics.
2. Mechanics (beginning with the second year.)
3. Fortfication and Entrenchments.
4. Attack and Defence of Fortresses.
5. Artillery, specially with reference to its effect and use (first year only).
6. Applied Tactics and Strategy (second and third years).
7. Military Geography (first year).
8. Military History (second and third years).
9. Practice in Memoirs, Reports, &c., to be written in French and German (first year).

Special studies.

Besides the above studies, there are,—

1. Specially for Artillery Officers :—Artillery considered with reference to the mechanical direction of the pieces, of gun carriages, &c.
2. Specially for Engineers :—Architecture, and specially the building of Fortresses.
   1. Mines of all sorts.
   2. Batteries, Trenches, and Saps.
   3. Experiments of all kinds in Artillery, in order to learn with precision the effect of Artillery.
   4. Knowledge and Use of Mathematical Instruments for Surveying, Theodolites, Sextants, &c.
   5. The working out of Applied Tactics, with reference to lines of country, fortresses, &c., done by the Students in the field (in the second and third years).

Practical Exercises.

The Practical Exercises go on for two days in each week, on which there is no teaching, during three months in the year.

The year's instruction lasts uninterruptedly for nine months; for the three remaining months the Officer returns to his regiment.

Each Teacher gives four lectures a week, of one hour each ; except the Drawing-master, who gives a lesson of two hours twice a week.

APPENDIX U.

Scharnhorst's Report on the War School at Berlin.

APPENDIX U.

VON SCHARNHORST'S OFFICIAL REPORT ON THE STATE OF THE WAR SCHOOL AT BERLIN AT THE END OF THE FIRST YEAR, 1811.

Review of Internal Condition.

Internal condition.

THE novelty of an institution in which considerable attainment is required as a title for admission, leads to the expectation that, in the first year, the number of Officers wishing to attend it will not be great, because that they would not venture to expose themselves to an Examination, where failure would be discreditable. Nevertheless, in a short time so many applied to be received into the School, while they also replied in writing to several of the questions proposed to them, that it was found impossible to comply with the request of all. Among those who wished to be received there was found, as was naturally to be expected, a great diversity in attainments. It would have been unfair to have sent those back who were already more advanced, and they, therefore, received permission to attend the School. Only one exception to this rule appeared to be necessary, from the remarkable circumstance that the exercises of all the Cavalry were among the worst. From this it seemed evident that a scientific course of culture was particularly necessary for the Officers of that branch of the Service, and permission was therefore granted to receive all Cavalry Officers, irrespective of the low and confused state of their previous acquirements. Ninety-seven Officers received permission to attend the Institution, although there was full accommodation for only fifty; and, besides these, six Officers of the garrison were allowed to be present at some of the Lectures.

Number of Students admitted.

From the great zeal with which young Officers crowded to this Institution, it seemed likely that they would take up too many different subjects at once, and be in danger of doing nothing thoroughly; as I must presume that, for the most part, they had no correct idea respecting a public Lecture on scientific subjects. In order to prevent this evil, and to inform them concerning the subjects of instruction, Captain Meinert gave a general survey, in some discourses to all the Officers, with reference to the Sciences taught in the School. Although I myself spoke afterwards to these young men on several occasions respecting the proper method of study, yet I could not prevent some of them from overloading themselves with subjects of a very different nature, all of which they prosecuted at the same time. It seemed to me to be of more importance to give my advice to the Officers than to restrict them, which I did as little as possible; because I thought it to be less injurious that they should go wrong once, than that their peculiar turn of mind should be confined; it was left free for any one who had undertaken too much to give up some of the subjects of instruction. So long, however, as this was not the case, it was the duty of the Class Inspector to see strictly that every one carefully attended the Lectures.

Subjects of Instruction: System and Progress of Scientific Work.

Subjects of Instruction in the lower Class.

In the Lower or First Class the following subjects were taught:—

Mathematics	in 312	Lectures.
Fortification	156	„
Universal History	156	„
Geography	156	„
German Language	156	„
„ „	156	„
French Language	156	„
„ „	156	„
Military Drawing	104	„
„ „	104	„

Study of Mathematics.

The greater part of the time was occupied with Mathematics, because this science is only to be viewed as the foundation of all further Military improvement, but also as the principal means of sharpening the intellect, and of acquiring a steady, logical style of thinking. As, however, the practice of the young men had been too limited to enable them to follow public Lectures in Mathematics, it was settled that the Lecture should partake more of the questioning or Socratic method, and allow of many repetitions. It was also confined to elementary principles, comprehending only Arithmetic, Geometry, Logarithms, Plane Trigonometry, and Universal Arithmetic, up to Equations of the second degree.

History.

The great extent of History, and the little time that could be spent upon it in the Lecture, rendered it necessary to select only the most interesting occurrences, which were treated in detail, while the less important were only slightly touched upon.

Scharnhorst's Report on the War School at Berlin.

In the Upper, or Second Class the following branches were taught in the course of the year :—

Mathematics for Engineers and Artillerymen	312	Lectures.
„ for Infantry and Cavalry	260	„
Tactics and Strategy	156	„
Skirmishing Parties, Staff Regulations, and a Sketch of the Operations of Artillery, Field Fortification, and Military Bridges	156	„
German Language	156	„
French Language	156	„
Physical Science	104	„
Veterinary Art	52	„
Theory of Surveying	52	„
Statics, Hydrostatics, Aerostatics for the Artillery and Engineers	26	„

Subjects of Instruction in the Upper Class.

To instruction in Mathematics in this class the greater part of the time is devoted, for the same reasons that have been already assigned.

Mathematics.

The knowledge of Mathematics to be found among the Officers of the Infantry and Cavalry was either too slight or totally wanting; and the examinations they underwent sufficiently showed that all the Officers were either more or less behind in this branch. All the Officers of the Artillery and of the Engineers had made, on the contrary, considerable progress in Mathematics; and they required a teacher for themselves alone, because they were required to go through a course of all the higher parts in three years, in order to render them familiar with their profession in all its extent; to which end the Institution afforded every facility, being intended for every arm of the Service. The Teacher here only slightly touched on the elementary principles, and dwelt longer on the higher parts. It was also chiefly for the Artillery and Engineers that instruction in Statics was given.

Physics and Chemistry.

In Physics and Chemistry, on the other hand, the Officers of the whole Service took an interest, because some knowledge of these sciences belonged to the general accomplishment of the Officer, and possessed an interest, in part, for every arm, although the Artillery and the Engineers were required to know them more intimately. The short time set aside for this allowed only of the thorough treatment of those portions which were of particular importance to the Military man.

Expectation that the exclusive spirit of the different arms will cease.

Since in this manner not only the Artillery and Engineers, but every Officer of the Army as well, has an opportunity presented to him of becoming acquainted with all he branches of Military Science, it is to be hoped that young men will distinguish themselves in all arms, and avoid the exclusive spirit which has hitherto separated each branch of the Service from the others.

Limited knowledge of mathematics possessed at entrance.

In the organization of the War School it was taken for granted that as regards Mathematics and languages for the Infantry and Cavalry, the Officers who attended the Institution would, at least, possess the measure of information communicated in the first class, and pre-supposed to exist in the Examination for Officers; and in accordance with this, the instructions for the course to be followed in teaching by the different Professors in this class were drawn up. The instruction was intended to begin in this class where it ended in the first; experience, however, as well as the specimens of the work sent in, soon showed that even this small measure of previous attainment was by no means so generally found among the Officers as had been expected; and it became necessary to notify to the Teachers that they might deviate from their directions, and first of all satisfy themselves as to the degree of knowledge possessed by their audience, in order to modify their Lectures accordingly.

Tactics—taught more by practice than theory

More attention is paid in Tactics to their practice than to their theory, for acquiring which an opportunity is afforded on the exercise ground, as it is chiefly taught by examples, in order, as far as possible, to supply the want of experience in actual warfare, and to prevent the danger of mere speculations. Many problems are given, in order to exercise the faculty of judgment, to put their powers to the test, and to give them an opportunity of bringing their talents into play.

Expectation of the advantages of common instruction.

I trust that from this amalgamation of the different arms there will arise, not only mutual confidence and esteem, but also in future a proper estimation, both of what can be done by each branch of the service and of what cannot, and a more correct practice of each, both singly, and also when mixed up with others. This is a subject the difficulty of which is evident on the occurrence of every manœuvre.

As an incentive to diligence, I beg most humbly that Your Majesty would be pleased to grant some favours to this Institution, namely,—

Recommendations.

1. That the Regiments be informed that from this time forward no one can become an Officer who has not undergone a thorough examination in the manner before laid down. The reasons why this has hitherto been not attended to, were—

(*a*) Some of the different First-class Ensigns behaved themselves well in the late war.

(*b*) Excuses were made on the want of means of acquiring knowledge.

Both circumstances no longer occur, for four years have passed since the war, and all those who distinguished themselves then, for which, on the whole, there was so little

APPENDIX U.

Scharnhorst's Report on the War School at Berlin.

pportunity, have long since no doubt become Officers. But the opportunity of making some acquisitions in knowledge is now given to every one through Your Majesty's favour and the foundation of the War School. Nothing but a total deficiency in talent or right intention can, therefore, be a reason for ignorance, and both causes are deserving of no consideration.

Recommendations.

2. I would beg Your Majesty's permission to be allowed occasionally to propose that some of the most distinguished young man of the War School be placed in the Adjutants' Department. There will always be an opportunity for doing this, as Your Majesty has established the principle that Officers may be sent back to the troops from the Adjutants' Department and the Staff, whereby the twofold advantage arises of placing young men who are not fit for the former post in situations that are more commensurate with their abilities before they rise to higher posts; and again, of bringing young and able Staff-Officers into the Army, from which good Colonels of Regiments can be obtained, who have more knowledge of the use of the various arms than is, unfortunately, at present, usually the case.

Berlin, **July 15, 1811.** VON SCHARNHORST.

APPENDIX V.

SUPPLEMENTARY DOCUMENTS ACCOMPANYING COLONEL VON HOLLEBEN'S COMMUNICATION.

No. 1. (A.)

REGULATIONS FOR THE SUPREME BOARD OF MILITARY STUDIES.

§ 1.

Object. The Cabinet Order of December 20, 1855, of which a copy is annexed, appoints a Supreme Board of Military Studies, whose composition it prescribes, to assist the General Inspector of Military Instruction and Education in reducing to system and organic unity the various institutions for military education.

§ 2.

Meetings. The Board only assembles to deliberate and report its opinion when summoned by the General Inspector.

§ 3.

The questions brought before it comprise,—The organization of the military schools; the efficiency of their plans of instruction, and their harmony as concurrent parts of a system; their range, spirit, and method; their adjustment to the examinations, and all subjects connected with military education which the General Inspector may think fit to lay before it.

§ 4.

Every member has the power to call attention to any defects he may have observed, and to propose any remedies he may deem expedient, and by laying his views and reasons in writing before the Board, to occasion a consultation, and consequent representation of opinion to the General Inspector.

§ 5.

Proceedings. The Board is broken up into two divisions, in each of which, as well as in the united Board, the oldest military member is president. The first division is concerned with purely military studies, and consists generally of all the military members. The second division has for its province the general scholastic and academical sciences, as well as foreign languages; and is composed of the Director of the General War School, the Commander of the Corps of Cadets, all the members selected from the Professorate (*Gelehrtenstand*) and, if necessary, one or other of the military members of the Board.

§ 6.

Each of the two divisions is again subdivided into three sections; the whole Board, consequently, into six sections. The first section of the first division is concerned with tactics and military history; the second with artillery and fortification; the third with military geography, surveying and drawing. In the second division the fourth section deals with the study of mathematics; the fifth of history; and the sixth of languages, literature &c.

§ 7.

When the nature of the subject for deliberation requires it, mixed Boards, *ad hoc*, may be appointed by the General Inspector.

§ 8.

All orders issued by the General Inspector to the Board are addressed to the President, and the latter delivers the reports of the Board to the General Inspector.

§ 9.

The General Inspector determines whether a question shall be laid before the whole Board, or one of the divisions, or one or more of the sections.

§ 10.

The members who are to meet have ample notice from the President of the time and purpose of the meeting, that they may be prepared for deliberation.

APPENDIX V.

Supreme Board of Military Studies of Prussia.

§ 11.

For every subject that comes under consideration the President names a *Referent* and a *Co-referent*. The consultation is opened by the statement of the *Referent;* after which each member, beginning at the youngest, separately, and without interruption, gives a reasoned opinion. A discussion then follows, and finally the result is recapitulated by the *Referent*. The formula of the closing question is drawn up by the President, and voted on by all, beginning at the youngest.

§ 12.

A majority of the whole Board or of the division decides upon the resolution. If the votes are equal, that of the President decides. Every minority, however, and every single member, has the power to append to the resolution a separate vote, which is then laid before the General Inspector, along with the resolution of the majority.

§ 13.

If two sections are united for deliberation, and differ in their views, each returns a reasoned report of its own opinion.

§ 14.

The further details of its internal regulation are left to the discretion of the Board.

Berlin, May 24, 1856.
Office of the General Inspection of Military Instruction and Education. (Signed) VON PEUCKER.

No. 2. (B.)

REGULATIONS FOR THE BOARD OF STUDIES OF THE GENERAL WAR SCHOOL.

§ 1.

Board of Studies of Staff School.

The Board of Studies of the General War School is a consultative and deliberative Board, intended to promote the scientific objects of this institution for the highest military education. The Director of the War School is its President and Chief and the conductor of its official correspondence.

§ 2.

Members.

The Board consists at present of four members, two scientific Officers of rank (one of whom must belong to the Artillery or Engineers), and two members of the Professoriate of Berlin. They are all appointed by the King, upon the recommendation of the General Inspector of Military Education, who is advised by the Director of the War School. Their functions cease whenever their absence is required by other public duties. The General Inspector appoints a Secretary upon the recommendation of the Director.

§ 3.

Duties.

The duties of the Board, as fixed by the Cabinet order of the 20th of December, 1855, of which a copy is annexed, are to supervise—

1. The carrying out of the prescribed plan of instruction in the spirit of the regulations,
2. The activity of the Teachers,
3. The industry and progress of the Students, and
4. The general results of the machinery of instruction; and
5. To manage and augment the collections of scientific apparatus, so as best to promote the purposes for which they were formed.

§ 4.

The Board has to adapt the general plan of instruction laid down by the General Inspector to the wishes of the Teachers; to control the distribution of the day; and to recommend for permanent or temperary appointment on the Staff of Teachers. It has to examine and confirm the special plans of instruction proposed by the Teachers, and by frequent presence at the lectures to watch over their efficient execution. The Teachers have a right to defend and develope their plans in reply to any objections raised by the Board.

§ 5.

It is the right and duty of every member to bring before the Board, without waiting for any official summons, any points affecting the welfare and success of the institution, by delivering his suggestions in writing to the Director, who must then submit them to the Board for its examination and opinion.

§ 6.

The Board has to draw up the annual program of studies; to frame at appointed times examination papers for the admission of new students; to examine the papers worked by the candidates and appreciate them according to certain principles; to select those fit for admission, and to give their grounds in cases of rejection.

§ 7.

It has to co-operate with the Military Direction in making out a list of the Officers to be invited to join the higher cœtus, and to state the reasons in cases of rejection.

§ 8.

It has to examine the essays written by the Officers every quarter; and to judge both of the themes set by the Teachers, and of the performances of the Students; and at the end of the course to enter the results (*hauptcensuren*)* in the official register.

§ 9.

Duties.

It has to co-operate with the Military Direction in framing the certificates of those who have completed the triennial course, and recording upon them the results assigned by the Teachers.

§ 10.

It has to co-operate with the Military Direction in making, according to regulations, an annual report, mentioning by name the Officers who have gained the predicate of "Excellent" in the greater number of subjects, or who have received the special praise of their Teachers or of the whole institution.

§ 11.

The Board has the custody of the library, maps, instruments, models, physical and and chemical apparatus. It must annually, through one of its members, review these collections, ascertain their amount and condition, select the articles that require replacing, and superintend the catalogues and inventories.

§ 12.

It has annually to draw up, with due regard to the wishes of the Teachers, a scheme for the expenditure of the sums received from the public funds in the maintenance of the educational apparatus.

§ 13.

Neither the Board nor any of its members has the right of admonishing or rebuking any Officer, or of addressing animadversion or criticism to any Teacher. The Director, who is the sole head of the institution, can alone give effect to the resolutions and opinions of the Board. The Board can carry on no written correspondence with the General Inspector. On the other hand, the Director is bound to append the original protocol of their proceedings to the report that he bases upon them.

§ 14.

The Director appoints the days of meeting according to the exigencies of business distributes the subjects of inquiry (*Referata*) among the members as equally as possible, and assigns to each the branch of instruction he is to supervise. He may call on any member to investigate and report on any educational question.

§ 15.

All the members have an equal vote. When the number of votes on each side is equal, the vote of the Director decides. A minority, even if it consists of a single member, has the right of recording its dissent in a protocol, or adding it to the resolution of the majority as a separate vote, and requiring it to be delivered along with the resolution to the General Inspector. A protocol of every meeting must be signed by all the members present.

Berlin, the 24th May, 1856. VON PEUCKER.
Office of the General Inspector of Military Instruction and Education.

* The *predicates* or *censures*.

APPENDIX V.

Board of Studies of Divisional Schools.

No. 3. (C.)

Regulations for the Board of Studies of the Division Schools.

§ 1.

The Board of Studies for the Division Schools is a consultative and deliberative Board immediately subordinate to the General Inspector, whom it assists in the supreme control of these institutions, and with whom alone it has any official communication. Its functions are generally declared by a Royal Cabinet Order of the 20th December, 1855, a copy of which is annexed.

§ 2.

Members.

The Board is composed of four military members, the oldest acting as President, and one member of the Professoriate. One of the former must belong to the Artillery and one to the Engineers. All the members are nominated by His Majesty upon the recommendation of the General Inspector. Their office ceases when other public duties require their presence in another quarter.

§ 3.

Duties.

The duties of the Board are to watch over—

1. The systematic carrying out of the plan of education in the spirit of the regulations,
2. The efficiency of the Teachers,
3. The industry and progress of the Scholars, and
4. The results accomplished by the machinery of instruction; as also
5. To manage and augment the scientific collections belonging to these schools and the Division libraries, so as best to promote the ends for which they were established.

§ 4.

Accordingly, the General Inspector transmits to the Board for its examination and report all official reports and returns which he receives concerning either the Division Schools, or the Artillery and Engineers School, as also all questions affecting, in his opinion, the organization, prosperity, and progress of these institutions.

§ 5.

It is the right, and duty of every member of the Board to bring before it for its consideration, without waiting for any official summons, any points affecting, in his judgment, the well-being and success of the Division Schools. For this purpose he is to deliver a written statement of his recommendations to the President, who will submit it to the Board for its examination and opinion.

§ 6.

The instructions addressed by the General Inspector to the Board are sent to the President, who opens them, presents them to the Board, and takes the steps immediately required.

§ 7.

The President conducts the discussions and the course of business, and distributes the subjects of inquiry (*Referata*) as equally as possible amongst the members; on which account the latter must always report to the President their absence from Berlin whether on service or on furlough.

§ 8.

The President gives the members of the Board notice of meetings by a circular in which the object of the meeting is stated.

§ 9.

The deliberations are commenced by the opening statement of the *Referent*, who is followed by the *Co-referent*, where one has been appointed. A debate then follows, the result of which is recapitulated by the *Referent*, and finally the closing question is drawn up by the President, and put to the vote.

§ 10.

The resolutions of the Board are decided by a majority of votes. If opinions are equally divided the President has the casting vote; but a minority can demand that their opinion shall be laid before the General Inspector in a separate vote appended to the resolution.

§ 11.

A protocol of each sitting is drawn up, and the rough draught is signed by all the members. But the fair copies of less important protocols, as well as letters to the General Inspector, are, for the sake of despatch, signed by the President alone.

§ 12.

The details of internal regulation are left to the discretion of the Board.

Berlin, 24th May 1856.
Office of the General Inspection of Military Instruction and Education. (Signed) VON PEUCKER.

No. 4. (D.)

REGULATIONS FOR THE BOARD OF STUDIES OF THE CADET CORPS.

§ 1.

Board of Studies of Cadet Corps.

The Board of Studies of the Cadet Corps is a deliberative and consultative board for the promotion of the scientific objects of the Corps, with the Commandant of the Corps for its President and Chief.

§ 2.

Members.

It consists at present of one military member and one member of the Professoriate They are nominated by the King on the recommendation of the General Inspector of Military Instruction and Education, who is advised by the Commandant of the Corps.

§ 3.

Duties.

The Board has no direct official communication either with the General Inspector or with the Teachers and Students. The management of the Corps is entirely concentrated in the hands of the Commandant, who can alone give effect to the resolutions of the Board.

§ 4.

The Cabinet Order of the 20th of December 1855, of which a copy is annexed, defines it to be the function of the Board to supervise the systematic carrying out of the prescribed plan of instruction in the spirit of the regulations, the efficiency of the Teachers and the industry and progress of the Scholars, and the amount of result accomplished by the machinery of instruction.

§ 5.

The Board has annually at the commencement of the course to form a general plan of instruction in accordance with principles laid down by authority, and special plans for the various branches of study. It is its duty by frequent attendance at lectures, by constant presence at examinations, by control over the selection of themes and over the appreciation (*lehrercensuren*) of essays, to satisfy itself of the competence and efficiency of the Teachers, as well as of the industry and progress of the Students. At the termination of the course it has to construct, partly from the appreciative remarks (*censuren*) of the Teachers and partly from its own observations, a general tabulated statement of the results accomplished in all the departments of study.

§ 6.

The Board has to manage, maintain, and augment the libraries and scientific collections, in the way most conducive to the purposes for which they were formed.

§ 7.

It is the right and duty of every member to bring before the Board, without awaiting any official invitation, any points which he may judge of importance to the welfare and success of these institutions. For this purpose he is to deliver a written statement of his recommendations to the Commandant of the Corps, who will lay it before the Board for its examination and opinion.

§ 8.

The Commandant of the Corps conducts the proceedings of the Board, distributes the subjects of inquiry (*Referata*) among its members, and fixes the time of its meetings as occasion may require. He can at any time commission any of its members to report on any question within the province of the Board.

APPENDIX V.

Board of Studies of Cadet Corps.

§ 9.

Individual dissentients have the right of recording a separate vote, and requiring the Commandant of the Corps to lay it before the General Inspector.

Berlin, the 26th of May 1856. VON PEUCKER.

Office of the General Inspection of Military Instruction and Education.

APPENDIX W.

LIST OF TEXT-BOOKS USED IN THE MILITARY SCHOOLS OF PRUSSIA.

COMMUNICATED BY LIEUTENANT BERGER.

3, Leipziger Platz, Berlin,
26th May, 1856.

DEAR SIR,

I HOPE the list of books adjoined will arrive in good time; I was not able to send it sooner having been obliged to correspond with the different institutions, and then put their data together. You will observe that I send you no list of books used at the Staff School, there being no peculiar works introduced there, every teacher lectures after his own plan, containing the extracts from all the works considered the best on the respective subjects.

I have, &c.
A. W. BERGER,
Lieutenant, 28th Infantry Regiment.

Col. W. Yolland, R.E.

I.—*Cadet Corps.*

Cadet Corps.

1. Latin.—Zumpt's Latin Grammar. (Sexta-Prima.)
   Otto Schulz's Reading Book. (Sexta.)
   Bonnel's Reader. (Quinta.)
   August, Exercitia. (Quarta et Tertia.)
   Cornelius Nepos. (Quarta.)
   Cæsar di bello Gallico. (Tertia.)
   August, Introduction to Translation. (Secunda et Prima.)
   Ovid's Metamorphoses. (Secunda.)
   Q. Curtius. (Secunda.)
   Cicero, Orationes. (Secunda.)
   Virgil, Æneid. (Prima.)
   Livy. (Prima.)
   Tacitus. (Selecta.)
2. French.—Plötz, French Grammar and Introduction. (Sexta Selecta.)
   Voltaires's Charles XII. (Quarta et Tertia.)
   Beauvais, Practical Introduction to Translation from German into French. (Tertia.)
   Beauvais, Etudes Militaires. (Secunda.)
   Beauvais, Etudes Historiques. (Prima.)
   Drames de Molière. (Selecta.)
3. Mathematics.—Hallerstein, Elements of Mathematics. (Quarta-Prima.)
4. History.—Schmidt, Outlines of Universal History. (Sexta-Prima.)
5. Geography.—Carl Ritter's Works. (Quarta-Prima.)
6. Physics,
7. Chemistry. } Beetz, Outlines (*Leitfaden*). (Secunda et Prima.)
8. Mineralogy,
9. Botany,
10. Zoology. } The Elements, without any peculiar works being introduced.
11. Military Surveying.—Plehwe, Outlines of Surveying (*Leitfaden zum Aufnehmen*). (Prima et Selecta.)
12. Military Plan Drawing.—Plehwe's Plan Drawing (*Planzeichnen*). (Tertia Selecta.)
13. German.—The principal German Writers.
14. English.—Herrig's Works. (Selecta.)
15. Military Instruction.—Count Waldersee (present Minister of War), Instruction for the Service (*Dienst Instruction*).
    Pelchzrim, Instruction in Artillery Service (*Instruction im Artillerie-Dienst*).
    Berneck, Outlines for Military Service *Grundiss fur Militair Dienstchrift*).
16. Tactics.—Berneck, Elements of the Tactics of all Arms (*Elemente der Taktik aller Waffen*).
17. Lectures on Arms.—Hoffmann, Outlines for Preparation for the Officer-Examination (*Lietfaden zur Vorbereitung für das Officier-Examen*).
18. Fortification.—Rüppel, Elements of Fortification in the form of Outlines for the Officer-Examination (*Lehrbuch der Befestigungskunst als Leitfaden für das Officer-Examen*).

APPENDIX W.

Text-books used in Prussian Military Schools.

II.—*Division Schools.*

1. Military Surveying.—Plehwe, Introduction to Surveying.
2. Military Plan Drawing.—Plehwe, Plan Drawing.
3. Tactics.—Berneck, Elements of the Tactics of all Arms.
5. Lectures on Arms.—Hoffman, Outlines for Preparation for the Officer-Examination.
5. Fortification.—Rüppel, Elements of Fortification in the form of Outlines for the Officer-Examination.

III.—*Artillery and Engineers' School.*

I. Cœtus.

Artillery and Engineers School.

1. Artillery.—Behr's Outlines (*Grundris bei Behr.*)
2. Tactics.—Berneck, Elements of the Tactics of all Arms.
3. Military Surveying.—Feller, New Outlines (*Neuer Grundriss*).
4. Mathematics.—Lehmus, Pure Mathematics.
5. Geometrical Drawing.—Hirupe, New Introduction (*Neue Leitfaden*).
6. Instruction on Military Duty.—Berneck, Outlines for Military Service.
7. French.—Fröukel's Anthology. Ségur's works.

II. Cœtus.

1. Artillery.—Behr's Outlines.
2. Military Art.—Berneck, Outlines of the History of War (*Grundriss der Geschichte des Kriegswesens*).
3. Mathematics.—Lehmus, Pure Mathematics.
4. French.—Fröukel's Anthology. Molière.

III. Cœtus.

1. Artillery.—Behr's Outlines.
2. Mathematics.—Lehmus, Higher Analysis.
   Lehmus, Pure Mathematics.
3. Chemistry.—Werther, Outlines of Chemistry.
4. Knowledgeof Horses.—Hertwig's Handbook (*Taschenbuch*)

APPENDIX X.

EXTRACTS FROM THE REGULATIONS FOR THE IMPERIAL MILITARY ACADEMIES, AUSTRIA.

(*Reglement für die K.K. Militär Academien*, 40 folio pages, in lithograph, with Appendixes.)

The First Part,

On the Object of the Academies, and the Admission of Scholars,

Comprehends Sections 1 *to* 8,

Which merely give in complete detail the particulars which are stated at some length in the Official Abridgment, pages , as to the different kinds of pupils, their number, and the conditions of their admission.

The Second Part.

On the Numbers of the Scholars, the Numbers and Duties of the Teachers, Inspectors, and other Persons employed.

Section 9.

Number of Scholars.

The number of the scholars consists, in the Neustadt Academy, of 400 pupils; in the Artillery Academy, of 160 pupils and 40 attendant scholars (*frequentanten*); in the Engineers' Academy, of 160 pupils and 40 attendant scholars; and in the Marine Academy of 100 pupils.

In each Academy the scholars are divided into four yearly courses, or classes, as nearly as possible equal in numbers. In the Neustadt Academy, each class is divided into two sub-divisions.

Section 10,

Refers to the Appendix for the exact statement of the numbers of the teachers, inspectors, &c., in each Academy.

Section 11.

The Directors and the Officers employed as Teachers.

The Directors of the Neustadt Artillery and Engineers Academy must be of the rank of Colonels or Generals; the Director of the Marine must be a Field Officer. The education, the instruction, and the management are entrusted to their charge.

The Field Officers who serve in the Academies have in all cases, and the other Officers as a general rule, the duty of superintendence and discipline (*Inspections-dienst*) in addition to that of giving instruction as professors. The Officers in command of Companies merely undertake the duty of superintendence (*Inspections-dienst*) and give no instruction. The Officer of Engineers entrusted with the care of the building, the Riding Master, and those Officers whose lectures require special preparation, are exempted from the duty of superintendence. The duties of the Adjutant and Managing Officer are confined to the business of their respective offices.

To be qualified to hold an appointment in the Academies an Officer must have served in the army six years, and of these six two at least as an Officer.

One-third part only of the Field Officers and Captains (taken together) may be married men; the Subaltern Officers must all be unmarried men, or widowers without children.

Officers appointed to the Academies first complete a year's probation, and when their qualifications for the service of the Academy have been proved, they and their servants are placed on the list of supernumeraries in the corps to which they belong; and they are transferred to the academies. Their names are retained on the roll (*Rangsevidenz*) of the corps, but they receive their pay from the academies. They retain their right of promotion, and cannot be passed over either in peace or in war. Every subaltern officer without exception, including those on the pension (half-pay) list, after six years of good service without intermission, will receive extraordinary promotion to the rank of Captain of the first class. The year of probation is included in reckoning these six years.

Captains of the first class and Field Officers do not enjoy this privilege of extraordinary promotion after six years service; but those in active service receive promotion in the usual course of their corps* up to the rank inclusively of Lieutenant-Colonel, beyond which, with the exception of the Director of the Academies, no further promotion is allowed for service in the institutions for military education.

Captains of the first class, whether on active service or on the pension list, after six years' service as professors in one and the same charge, receive the double extra allowance (*Zulage*), and retain it so long as they continue in this charge.

Lieutenant-Colonels in active service who have served not less than six years in this

* *Mit seinem hintermann.*

duty with distinction receive, on being placed upon the retired list (*Ruhestand*) the rank (*Character*) and pension of a Colonel.

Captains of the first class, and Field Officers on the pension list, receive, on being placed on the retired list, provided they have served not less than six years in this capacity in the institution of military education, the brevet rank and pension of the next superior grade.

Any Officer appointed to a Military Academy has it at his choice to return to his corps; but he is bound to remain in the Academy either to the end of the school year, or, at any rate, until a successor has been appointed in his place.

Sections 12 *and* 13,

Describe the positions of the ecclesiastics and civilians employed as teachers, and of the surgeons and accountants attached to the Academies.

Section 14.

The Inspection Officers and other officials.

For the duties of Inspection, Sergeants are appointed from the troops. They must be unmarried, trustworthy, and instructed persons, and must have served at least four years. If found suitable for the post after three months' probation, they are permanently appointed to the Academy as Inspection-Sergeants, and are detached (*im abgang gebracht*) from their corps.

Each yearly course or division has two Inspection-Sergeants, and (except at the Marine Academy) for every two Sergeants a third additional Sergeant is appointed. They are employed in maintaining discipline (*Inspection*), in conducting the drill, in the gymnastic exercises, in teaching swimming, and, according to their capacity, as assistant *répétiteurs* (*Correpetitoren*) in Mathematics. One is attached to the Adjutant.

After six years' good service and conduct, the Inspection-Sergeant receives his promotion as Lieutenant of the second class, the three months of probation being counted in the six years. Those who distinguish themselves by the zealous discharge of their duties, and in particular those who have performed well the office of *répétiteur*, may hope for promotion at an earlier period.

If, on the other hand, the removal of an Inspection-Sergeant is, for whatever reason, considered desirable, he returns to his corps.

If an Inspection-Sergeant is invalided before his six years are out, the Director of the Academy will bring forward his case, with a view to provision according to his deserts being made for him.

The remainder of the Section relates to the Clerks, Servants, &c.

Section 15.

The body of troops detached on duty at the Academies

For the purposes of keeping guard in the house, cleaning the arms, making the clothing of the students, assisting in the practical exercises, &c. &c., every Academy has a detachment of troops placed at its disposal:—

The Neustadt Academy, 1 Sergeant, 2 Corporals, and 60 men of the Pioneer corps.

The Artillery Academy, 1 Sergeant, 2 Corporals, and 40 men of the Artillery.

The Engineers' Academy, 1 *Führer*, 2 Corporals, and 40 men of the Engineer corps.

These detachments are to consist of men of good conduct, thoroughly acquainted with the drill of their corps. In those taken from the Pioneer corps, there should be men skilled in masonry and carpentry, under the Officer entrusted with the care of the buildings, to assist in any necessary repairs.

The men are treated as supernumeraries in their corps, are attached to the Academies, and are recruited from their respective corps.

Sections 16 *and* 17,

Relate to the Muster Roll (Evident-haltung) *of the Academies and the Returns to be periodically furnished to the Fourth Section.*

THE THIRD PART,

ON THE PAY AND DRESS OF THE TEACHERS, INSPECTORS, AND OTHER OFFICIALS,

Comprehends Sections 18 *to* 21.

THE FOURTH PART,

ON THE DRESS, FOOD, AND SANITARY CARE OF THE SCHOLARS, AND THE PAY OF THE *FREQUENTANTEN*,

Comprehends Sections 22 *to* 27.

The Fifth Part,

On the Instruction,

Commences with Section 28,

Which treats of the theoretical instruction, referring for particulars to the Tables drawn up officially for the arrangement of the studies. The Scientific Instruction.

The Directors of the Academies, after conferring with the Professors, are to submit every year, at the end of July, their proposals for the Tables of the Studies of the ensuing year to the Supreme War Department.

Section 29,

In like manner, refers, on the subject of the practical exercises, to the Tables. The Practical Instruction.

The practical instruction is to be given throughout the year, but more especially in summer and after the close of the Yearly Examinations. On the 1st of July, the Directors of the Academies forward the programs of the Examinations, drawn up according to the prescribed form (No. 13), to the Supreme War Department.

Section 30.

The Yearly Examinations commence in all the Academies on the 15th of July; those of the fourth year beginning first. The Examinations.

Half-yearly Examinations take place only in the Marine Academy, and merely in the mathematical subjects; the time being the last week of February.

The Examination in the subjects of the fourth years and in the subjects of the three preceding years which have been completed in those three years must be conducted in the presence of the Director, the whole of the Field Officers, and the Commandant of the Company. One Field Officer and the Commandant of the Company attend the Examinations of the other three years, the Director merely attending as his other duties allow, when the importance of the subject or the need of forming a judgment on the teachers and the students may appear to require it.

As a general rule, a General Officer will be sent by the Supreme War Department to examine in particular subjects.

The Examination for the close of the fourth year is to be conducted with much solemnity; the other Examinations may, according to the number of the Field Officers, be held two or three at the same time.

Immediately after the Examination in each subject the notes of qualification are revised, and the requisite list signed by all present.

The qualification lists for all the academies must be sent in, drawn up according to Form 14, to the War Department; those for the fourth year, before the 16th of August, those for the other years, before the 10th of September,

No list is sent in to the War Department for the Half-yearly Examination at the Marine Academy, but merely a report.

The interval between the close of the Yearly Examination and the recommencement of the course of instruction is assigned as a period of recreation for the teachers and students. No instruction is given during this period; care, however, must be taken to check any tendency to idleness by a judicious employment of questions given to work out, united with recreation and exercise in the open air.

The names of students who have been kept back in their studies by ill-health may be submitted to the War Department, with a view to their receiving permission to go through the course again.

A second permission to go through a course is not given. The student must quit the academy.

The Sixth Part.

On the Moral and Physical Training of the Scholars, and the Distinctions of the Pupils.

Section 31,

Speaks at length of the moral and religious education of the students. Moral Education.

The students have to attend mass on Sundays and festivals, and to confess and communicate once a quarter. Those who have not been confirmed have to be so while at the Academy. Pupils who are not Roman Catholics have to attend the general religious instruction of their class. Care, however, is to be taken that they attend, if possible, the religious service of their own confession several times in the year. The Directors are to arrange accordingly with the Military Vicariate-Apostolic (*Feldvicariat*).

A special fund is set apart, out of which allowances of money are made to students who behave well. Every student receives a monthly allowance of twenty *Kreutzers* (eightpence) for pocket-money. Out of this pocket-money deductions are made for all damage done to the books and furniture.

APPENDIX X.

Regulations of Austrian Military Academies.

Section 32,

Relating to bodily education, directs that—

Every day, unless extreme heat, heavy rain, or snow interfere, the students shal lbe sent to walk out, if possible, in the grounds of the institution. In winter they are to skate; in summer they are to be in the open air after breakfast, and on Sundays and festivals to go on long walks in the afternoons. The space of time allowed for exercise in the open air is to be very considerable during the summer.

Bodily Training.

For gymnastic exercises reference is made to the table of the distribution of time.

Section 33

Distinctions.

Appoints certain distinctions (in the collar of the uniform, the pattern being given in an Appendix) to mark the best conducted students and the well conducted students.

Four of the best students of each class are named as sub-officers, and wear distinctive marks as such on their uniform.

The Seventh Part.

On the Buildings and Grounds.

Section 34.

Buildings.

The buildings of the academies are to contain sufficient room to accommodate, in addition to the students, the whole, or, at any rate, the largest part of the establishment.

In the Artillery and Engineers Academies separate accommodation is provided for the attendant scholars (*frequentanten*). The classes have each of them their own class-room and separate dormitory; and they have in common one room for drawing, one dining hall, one dancing room, fencing room, and gymnastic room.

The size of each room is to be proportioned to the numbers to be accommodated. The minimum of space in the class-rooms is twenty-four square feet of flooring per head, and in the dormitories forty-eight. The normal height of the class-rooms is to be thirteen, and in the dormitories fourteen feet. The class-rooms, as a general rule, are to be on the first, and the dormitories on the second floor. The gymnastic room is to be sixty feet long by forty feet broad, and sixteen feet high.*

Three or four rooms, according to the number of students, separated as far as possible from the rest of the building, are to be set apart as hospitals, affording accommodation in the Neustadt Academy for twenty or twenty-five, and in the Artillery and Engineers Academy for ten or twelve.

The corridors are to serve for parading the students, for exercises, and for facilitating the superintendence of the class-rooms and dormitories.

The Academies are to be provided with baths and ice-cellars.

Section 35

Grounds.

Gives directions as to the grounds or gardens with which each Academy is to be provided It is to contain walks, playground, gymnastic ground, and, if possible, to include the swimming school.

The Eighth Part,

On the Furniture, &c.

Comprehends Sections 36 *to* 38.

The Ninth Part.

On the Order to be kept in the Academies.

Section 39.

Service of the House by day and by night.

Military order and cleanliness must prevail in all parts of the Academies. The Inspecting Corporals are expected to attend strictly to this.

The nature of military education demands that the pupils from their youth up should be habituated to that punctuality and exactness which is exacted from the military above all other classes, and in the maintenance of which they themselves hereafter will have to co-operate as Superior Officers.

The pupils of the Neustadt Academy are divided into four, and those of the Artillery and Engineers Academies into two companies; two yearly courses or two divisions forming one company.

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* The Austrian foot or *Schuh* is a trifle longer than the English. The proportion is stated to be 80 of the former to 83 of the latter.

Each company is placed under a special Commandant, exempted, in accordance with Section 11, from the duty of teaching. Those in the Artillery and Engineers Academies undertake further the charge of the attendant scholars (*frequentanten*) of the same yearly course. The other Officers concerned with the duty of inspection are in equal proportion to the companies, and the Inspection Sergeants in accordance with Section 14. In the ordinary marches the single classes or divisions form in two lines. The pupil sub-officers take their places on the two wings and in the centre. When two or more classes go out together the pupils are drawn up in three lines, and form as a rule one division, the pupils of the highest class taking in turn the places of charge (*chargenplätze*).

For exercises in larger numbers and on state occasions, the pupils of the Neustadt Academy form a battalion of four companies, under the command of the Field Officer entrusted with giving instruction in practical exercises, who is accompanied on these occasions by a mounted pupil as Adjutant. The corresponding Officer takes the command in like manner at the Artillery and Engineers Academies on such occasions.

The attendant scholars (*frequentanten*) only go out with the other pupils for their practical exercises, and upon state occasions. In these latter cases they constitute a half company under the command of the senior in rank among themselves, and form on the right wing of the others, in the same line, at a distance of twelve paces.

The general occupation of the students is determined by the authorized time table, from which no departure is to be made. The hour of rising, from the 1st of April to the end of August is 5 a.m., and from the 1st of September to the end of March 6 a.m. The hour for going to bed is 9 p.m. both in winter and summer. After rising, the pupils have an hour allowed for washing, cleaning their clothes, and dressing; they are then inspected by the Sergeant, perform their devotions, and in winter go into the refectory to breakfast.

The signal is given for all the principal points in the distribution of time by the trumpet or horn.

Passage from one hall to another, going to or returning from church or from walks, must take place in military order.

The dormitories, corridors, &c., are all to be lighted, as far as is required for the safety of the house and the superintendence of the pupils, during the whole night.

One servant keeps the fire-watch in each dormitory, and one Officer with one Sergeant in the buildings in general.

Two or three Inspection Sergeants sleep in each dormitory, their beds being screened off from those of the pupils.

Section 40

Leave for Visits allowed to the Scholars.

Relates to the permission given to the pupils to go out on visits from the Academies. This is given only on Sundays and Feast Days, between the hours of half-past eleven a.m. and half-past seven p.m. The *frequentanten* are allowed to go out freely on Sundays and Feast Days from after dinner to retreat-beating.

Section 41

Relates to the amount of leave of absence to be allowed to the Officers as well as the pupils.

Leave of Absence allowed to Officers and Scholars.

The Directors of the Academies cannot be absent even for a few days without leave from the War Department.

The Officers may have leave from the Directors for the space of a fortnight after the yearly examinations are concluded. During the school course any leave of absence exceeding forty-eight hours requires a permission from the War Department.

The *frequentanten* and the best pupils may, after the end of the yearly examinations and the practical exercises, be allowed leave to go home for fourteen days, and the good pupils for eight days.

The remainder of the section relates to cases of sickness.

The Tenth Part.

On the Departure of the Scholars.

Section 42.

Promotion in the usual course on leaving.

According to the results to be derived from the qualification lists to be presented in accordance with Section 30 by the Directors, and from the recommendations therein contained ensues, upon the proposition of the Section of Military Education, the nomination or promotion by His Majesty the Emperor of the pupils of the fourth year, in the case of the pupils of the Neustadt, the Artillery and Engineers Academies, to the rank of Lieutenants of the Second Class. Their own choice is, as far as possible, attended to in distributing them into the different Regiments.

Pupils who do not pass the fourth year's course satisfactorily are sent to the Army as Cadets; this, however, is a case which, in consequence of the previous selection and sifting which has taken place, it is expected will rarely occur.

APPENDIX X.

Regulations of Austrian Military Academies.

A statement of the allowances made, on leaving, to the pupils and the *frequentanten*, is given in Appendix 19.

For pupils of the Neustadt Academy who wish to enter the Cavalry, their parents or guardians have to give security for a monthly allowance of at least twenty-five florins (2*l.* 10*s.*), and have, before the last day of June, to lodge in the hands of the Director a sum for outfit, amounting, in the case of an Hussar or Lancer Regiment, to 1,000 florins (100*l.*), and in that of a Cuirassier of Dragoon Regiment to 800 florins (80*l.*) This is to be paid over to the Regiment immediately on the appointment being made.

A copy of the pupil's qualification paper is to be sent to the corps to which he is appointed.

Section 43

Dismissal.

Contains, in reference to the removal of pupils for want of capacity or misconduct, the directions already given in sufficient detail in the Official Abridgment, page

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The Eleventh Part.

On the Control of the Academies.

Section 44.

Control.

The control of the Academies is in the hands of the Supreme War Department.

It is in all matters direct and immediate. The War Department sends a General Officer or Field Officer of high rank for their occasional inspection.

The nomination and removal of all the Officers of the establishments, the reception, transfer, and removal of the pupils, all proceed from the War Department.

Applications for employment in the service of the Academies are to be first registered in the War Department. All Officers and Inspection Sergeants who seek for employment in the Academies are to apply for registration to the War Department. These applications are to be accompanied by the conduct-lists.

To procure the *führers*, clerks, drummers, trumpeters, and private soldiers, required for service, the Directors apply to the Commanders of the Armies, Army Corps, &c., who supply them, according to a list of registration kept for the purpose, with the most trust worthy persons from the list of leave (*Urlaubenstand*).

Without the authority of the Supreme War Department no alteration whatever can be made in the organization, the plans of study, or the time-tables of the Academies.

The statement to be drawn up according to Form No. 20, as to the punishments inflicted by the Directors, is to be presented, without comment, at the end of every month to the War Department.

At the close of the school year, the conduct of every individual professor and master is brought under review by the War Department, and the condition of the institution in all respects in like manner considered.

Sections 45 *and* 46

Relate to the financial control, which belongs to a special Officer of the Commissariat, and the jurisdiction which is entrusted to the Head of the Fourth Section of the War Department, whose powers extend over all persons with the exception of the Directors. He delegates his powers to the Directors, who exercise them with the assistance of the Auditor (military lawyer) attached to the institution.

The ordinary business of the Academies is conducted and transacted by the Adjutant, the Auditor, and the Accountant.

The Twelfth Part

Comprehends Sections 47 *to* 58, *which*

Are all occupied with minute directions as to details of household and financial management. The Director has the general management, but the details are put in the charge of a special functionary, a Field Officer, who has the title of the Œconomy-Officer, and is assisted by the advice of the Inspecting Commissariat Officer.

APPENDIX to the Regulations of the Academies, No. 14. Specimen Qualification List. (Neustadt Academy.) Fourth Year, 1st Division.

Current Number.	Distinction.	Name.	Holds a	Birth-place and Country.	Age at the end of September in the current Year.	Religion.	Position, Employment, and Place of Residence of the Parent.	Height: Of the present Session.	Height: At the beginning	Height: At the end	State of Health.	Disposition.	Conduct.	Industry.	Religious Instruction.	Languages.	Logic, &c.	Geography.	History.	Higher Analysis; Analytical Geometry.	Mechanics; Spherical Trigonometry; Mathematical Geography; Trigonometry.	Physics; Elements of Chemistry.	Practical Mensuration; Surveying at Sight.	Military Composition.	Study of Law.	Military Penal Law and Procedure.	Pioneer Service and Field Fortification.	Arms and Munitions.	Permanent Fortification.	Civil Architecture.	Military Drawing.	Descriptive Geometry.	Rules of Drill and Exercises: Infantry.	Rules of Drill and Exercises: Cavalry.	Rules of Manœuvring.	Rules and Regulations.	Bodily Exercises: Riding.	Bodily Exercises: Gymnastics.	Bodily Exercises: Fencing.	Bodily Exercises: Dancing.	Bodily Exercises: Swimming.	Total.	Place in Class.	Common Drawing.	Has repeated a Class, and why.	Proposed by the Director.	Remarks.
1		Joseph von Abingen.	Half-free place.	Herzogenburg, Lower Austria.	19 7/12	Catholic.	Colonel of the nth Dragoon Regiment.	5 6/12	5 4/12		Healthy.	Rather irritable.	1	e	1	e	1	1	e	1	1	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	75	3	e	-	As 2nd Lieutenant in the —th Lancers Regiment, fulfils the stipulated conditions.	
2		Ludwig Armann.	Military place.	Linz, Upper Austria.	19 7/12	Catholic.	Half-pay Captain at Brünn.	5 7/12	5 5/12		Healthy.	Good natured.	E	1	e	e	E	1	e	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	66	6	-	-	As 2nd Lieutenant to the Emperor Alexander's 2nd Infantry Regiment.	
3		Ferdinand Brenner.	Military place.	Schwatz, Tyrol.	19	Catholic.	Was Major in the nth Regiment of Infantry, fell in battle; the Mother lives at Hall.	5 5/12	5 3/12		Healthy.	Straight-forward.	E	1	e	E	1	e	2	1	2	1	e	1	e	1	e	1	e	1	e	1	e	1	e	1	e	1	e	1	e	1	73	5	-	-	As 2nd Lieutenant in the Imperial Rifles, or in the 10th Rifle Battalion.	
4		Carl Casatelli.	Lombardo-Venetian foundation.	Milan, Lombardy.	18 11/12	Catholic.	Was Imperial Post Inspector; dead. Mother lives at Milan.	5 6/12	5 4/12		Healthy.	Passionate, but good hearted.	e	e	E	E	e	1	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	90	2	E	-	As 2nd Lieutenant in the —th Infantry Line Regiment.	
5		Georg. Baron von Dengen.	Lower Austrian foundation.	Vienna, Lower Austria.	19 5/12	Catholic.	Imperial Counsellor at Salzburg.	5 3/12	5 2/12		Shortsighted.	Somewhat thoughtless.	1	1	1	1	e	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	e	1	e	1	e	1	e	1	e	1	62	8	-	-	As 2nd Lieutenant in the Infantry Line Regiment.	
6	Student Sub-officers.	Anton Elsner.	Praying place.	Tetschen, Silesia.	19 4/12	Protestant.	Owner of a manufactory in Troppau.	5 7/12	5 7/12		Healthy.	Quiet and grave.	e	1	e	e	1	1	1	1	1	e	1	1	e	1	e	1	e	1	e	1	e	1	e	1	e	1	e	1	e	1	64	7	-	-	As 2nd Lieutenant in someGerman Infantry Regiment of the Line.	
7		Johann Fritsch.	Military place.	Brünn, Moravia.	12 2/3	Catholic.	First Lieutenant in the 2nd Regiment of Artillery.	5 3/12	5 1/12		Healthy.	Good tempered.	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	116	1	E	-	As 2nd Lieutenant in the Archduke Charles' 3rd Infantry Regiment of the Line.	
8		Stanislaus von Gromalsi.	Galician Estates foundation.	Sambor, in Galicia.	19 7/12	Catholic.	Employed in the Imperial Salt Department at Bochnia.	5 11/12	5 11/12		Healthy.	Lively and Cheerful.	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	E	E	E	E	E	E	E	E	E	E	73	4	-	-	As 2nd Lieutenant in a Galician Regiment of the Line.	

Amount of Progress.

WIENER NEUSTADT, —th August, 1855.
N. N., Major-General, Director of the Academy.
N. N., Major.

N. N., Lieut.-Colonel
N. N., Major.

APPENDIX X.

Regulations of Austrian Military Academies.

Note in Explanation of the Qualification List.

To mark the progress of the pupils in each of the subjects of study the following notes are used :—

E, e, 1, 2, and 3.

In order that the same note may have the same signification, the following rules are to be observed :—

System of Marks.

E signifies exemplary progress; rapid and correct apprehension of subject treated, with the ability to repeat it immediately afterwards, with the assistance of the instructor; general knowledge of what has been taught, coupled with good foundation; good manner of expression.

e—Good progress; rapidity of apprehension, but in a less degree; general and well-grounded knowledge; good manner of expression.

1—Pretty good, satisfactory progress; sufficient knowledge of principles to be enabled to comprehend the ensuing subjects, and make satisfactory progress.

2—Moderate progress; incomplete knowledge of things; the necessary knowledge for further progress not yet acquired, still giving hope that by further study or greater diligence this will be acquired.

3—Little progress, or none at all; ignorance of things, coupled with proof of incapability of comprehending the further subjects of instruction, and making a satisfactory progress.

There are thus three notes for satisfactory progress, and two for unsatisfactory.

Similar notes are to be given for the Practical Exercises and the Gymnastics, as well as to mark the conduct, the abilities, and the diligence; for example, the note 1 denotes satisfactory conduct, competent ability, or sufficient industry; the note 2 marks the contrary.

The teachers are to take great care in awarding their notes. The examination of several pupils at the same time, the comparison of their work, indeed, attention given to the opinions of the better pupils may guard the teachers from making false judgments, or acting with partiality.

It is less the absolute knowledge than the progress of the pupils that is to be weighed.

For passing from one class into the other, the general notes at the end of the half-year or year are to have value along with the monthly notes.

A change of the qualification (note), in consequence of the examination, can only be made with the consent of the Professor.

The conduct of each pupil will be half-yearly fixed by the Captain of the Company and the Inspection-Officers of the Company, and submitted to the Commission consisting of the Director and the Staff. The notes of ability and diligence are given by the Captain of the Company, regard being had to the reports of the Professors.

The notes have the following numerical values :—

E=4, e=3, 1=2, 2=1, 3=0.

Value of the notations.

These numerical values, however, are to be doubled for certain studies which are of more importance, or require greater application than the others. For this the sanction of the Supreme War Department is required. For the Neustadt Academy these studies are as follows :—

1st year.—1. Higher Analysis, Analytical Geometry. 2. Military Composition. 3. Military Surveying.

2nd year.—1. Mechanics, Spherical Trigonometry, Mathematical Geography, Triangulation. 2. Military Composition. 3. Military Drawing.

3rd year.—1. Physics, Principles of Chemistry. 2. Military Composition. 3. Military Drawing.

4th year.—1. Military Composition. 2. Military Drawing.

It is not necessary to mark religious instruction with the higher proportion, but the note (1) at least must be obtained, otherwise the conduct note will be lowered.

The military subjects of instruction for the special arms being divided into several branches, receive by this means a greater total of notes.

The notes for conduct, ability, diligence, and physical exercises are not included in the computation, but are acknowledged by leave of absence, dining out, giving pocket-money, &c.

The notes in Drawing, being not an indispensable subject, are not included.

Classification.

The general total is made by adding up the values of each note. The notes for such subjects as are completed in the earlier years are carried foward, and their values (doubled when necessary) included in the general total. If a pupil, on account of illness, has not received notes in one or more subjects, the total shall, nevertheless, be made. According to their progress, the pupils of each year are classified, the one who has had the greatest total being placed first. If two pupils have the same total, the higher rank is given to the one who has the higher note in physical exercise, and if the note here again is the same, then according to the classification in the previous year, and in the first year according to the decision of the Director.

Those pupils who have received no number in the total are not entered in the list of classification.

The pupils, according to their conduct and their total (special regard being had to the religious instruction), are divided into three categories; namely, exemplary, or pupils with double distinction; good, or pupils with simple distinction; and middling.

In order to be in the "exemplary" or "good" category, the note 1 in conduct and religious instruction is, at least, necessary. The notes 2 or 3 place a student, without any regard to the total, into the category "indifferent." To be placed in the category "exemplary," the smallest total admissible is that which would be represented by the note 2 given in each study, regard being had to its double value when necessary. For the category "good," the smallest total is that which would result from the summation of the note 1.

Distinctions.

By the above it will be seen, that while the class list depends upon the progress in Science and Drawing, the granting of distinctions depends upon other causes.

The class rank and the distinctions are determined anew at the end of March, after the yearly examination.

Pupil Sub-Officers.

The pupils who have, on account of illness, received no total, remain, if in the first year, without distinction; in the other years they retain provisionally that of the previous year.

The Pupil Sub-Officers are appointed by the Director, on the proposition of the Captain of the Company. The note E in *conduct* is necessary.

When a Pupil Sub-Officer sinks in rank below the 8, or loses the note E in conduct, he is allowed half-a-year to recover it. If he does not recover it in this period, he is reduced, and another pupil appointed in his place. He can be reduced at any time for misconduct.

APPENDIX Y.

Regulations of Austrian Staff School.

APPENDIX Y.

THE EARLIER PARTS OF THE REGULATIONS FOR THE IMPERIAL WAR SCHOOL, AUSTRIA.

(Reglement für die K. K. Kriegs-Schule.)

The First Part.

Object of the War School, and Admission to the same.

Section 1.

Object of the War School.

The object of the War School is to educate Officers for higher appointments, but especially for the Staff and the office of Adjutants.

Section 2.

Conditions of admission to the War School.

All Subaltern Officers of the standing army, without distinction of arm, have a claim to be admitted into the War School, if they can comply with the following conditions. They must not be less than twenty-one, nor more than twenty-six years of age; they must be single; they must have served uninterruptedly at least two years as Officers; and they must have passed the entrance examination.

Section 3.

Registration.

In order to be admitted to the entrance examination, the aspirant must first of all be registered for the purpose, for which he is to apply in the ordinary course, according to the rules of the service, to the Supreme War Department. A superior Officer is only justified in refusing the request of an aspirant, when the latter has not served his full two years as Officer uninterruptedly and without blame with the troops. It is open, however, to the respective Officers to state their reasons for or against the eligibility of the aspirant in the papers accompanying his application.

The latest statement of conduct must accompany the request.

The Supreme War Department then decides upon and ratifies the registration of the aspirant for the War School.

Section 4.

Entrance examination.

The entrance examination takes place in the War School between the 10th and 20th days of the month of October, for which purpose the registered candidates will be ordered to Vienna at the beginning of October; the requisite travelling expenses will be refunded by the Treasury. The subjects in which the candidate has to be examined at the entrance examination are:—1, Mathematics, as far as (inclusively) Spherical Trigonometry; 2, Geography; 3, History; 4, Arms and Munitions; 5, Field and Permanent Fortification; 6, Pioneer Service; 7, Rules of Drill and Exercise in detail for the arm, and of other arms in general; 8, Rules of manœuvring; 9, Military Drawing from a copy placed before him; 10, Military Composition, by working out an example in the presence of the Examining Board; 11, the French language; 12, lastly, the candidate must be able to speak one of the Austrian national languages, namely, either Slavonian, Hungarian, or Italian, and write a current legible hand.

The knowledge of these subjects will be required to the extent comprised in the books of instruction appointed for use at the Neustadt Academy.

Section 5.

Board for admission.

The Board for examination for admission is composed of all the Professors of the War School under the presidency of the Director.

The questions proposed to the candidate must be of such a nature that their solution may justify the conviction above all things that the Officer possesses a correct judgment in the appointed subjects, should even the details have escaped him. Added to this, a quick apprehension and the power of expressing himself both by word of mouth and in writing, on which account he has to answer the questions partly orally and partly on paper.

The amount of positive knowledge already acquired is not so much the question as the existence of those qualities which are indispensable to satisfactory progress in the War School. These qualities are, a clear understanding, a quick apprehension, and that general knowledge which forms the basis of the subjects treated of in the War School.

Section 6.

Regulations of Austrian Staff School.

The Report of the examination (*Prüfungs-Act*) of every Officer summoned to examination is to be drawn up separately for each according to Form No. 1.*

The Board for examination for admission are to return an impartial decision clearly and decisively expressed in writing both on the *vivâ voce* and on the written answers to the questions; in which every member of the Board is entitled to state his opinion, even if somewhat differing from that of the other.

Report upon the Examination.

Under the head "Remarks" any peculiarly striking advantageous or disadvantageous qualities of the Officer are to be placed. An account is to be given of his mental qualifications, and finally a statement is to be made of the views of the Board as to the fitness or unfitness of the candidate to be admitted into the War School.

Every member of the Board is bound to state his opinion conscientiously and to the best of his ability. When a diversity of opinion occurs, the majority decides, and when opinions are equally divided, the President has the casting vote. Every one, however, can state his difference of opinion at the foot of the protocol. At the close of the examination the protocol will be signed by the members of the Board for examination for admission and by the President, and together with the written answers and the specimen drawings, will be placed with the form of examination.

Section 7.

Report of the examination.

The whole number of Reports on the candidates examined, together with a report from the Director, will be placed before the Supreme War Department not later than the 20th of October. In this report all those Officers who have been considered fit to be received into the War School will be named in the order of merit as determined by the examination.

Section 8.

The admission.

Upon the basis of the Report made by the Director of the War School, together with the Reports on the candidates' examinations, the requisite proposals will be presented by the Supreme War Department to his Majesty, who decides upon those to be admitted into the War School.

The decision of His Majesty will be announced in the Military Gazette.

The Second Part.

Number of the Attendant Pupils;† Number and Duties of the Teachers, Inspectors, and Servants; Number of the Horses.

Section 9.

Number of the *Frequentanten* or Students.

The number of the *Frequentanten* will be fixed to thirty; they will be divided into two yearly courses. The *Frequentanten* retain their rank in their regiments, and in peace are regarded as upon temporary service. In war time they will be incorporated in their division of the army as supernumerary. They receive their promotion regularly, and may not be passed over either in peace or war.

Section 10.

Number of the teachers, inspectors, and servants; also, concerning the horses.

The list of the teachers, inspectors, and servants, and the account of the horses will be found in Appendix No. 2.

Section 11.

The Director a Field Officer; his province.

The Director of the War School is a General or Field Officer of high rank, who must possess a thorough military education conjoined with considerable experience, especially in the service of the Staff.

Impressed with the high responsibility of his office, he must strive to fulfil with unwearied activity the important duties which the confidence of his Sovereign has intrusted to him.

The Director of the War School must be a man peculiarly fitted for his position, and inspired above everything with true military *esprit de corps*, to teach those under him, both by precept and example, unqualified obedience and unshaken loyalty and attachment to their Sovereign; the establishment of the true renown of the institution must be his highest endeavour.

The Director is the head of the War School in all its branches; he has particularly to see that the instruction is given in entire accordance with the plan approved of by the

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* See the specimen given in the last Note to the account of the War School, page 181.

† The term *Frequentanten* is used here as elsewhere in the special sense of scholars *attending* from the army, without losing their position in their corps. The term is preserved throughout the regulations, and is simply equivalent to *Students*.

APPENDIX Y.

Regulations of Austrian Staff School.

Emperor. He shall make himself thoroughly acquainted with the performances of the Professors, as well of the *Frequentanten*, and by attending the lectures and by examination of the problems proposed by the Professors, convince himself that they understand their vocation; the whole establishment belonging to the War School is under his directions and he exercises over it the same power of discipline and punishment as by the rules of the service are intrusted to the Commander of a Regiment.

Section 12.

The Officer appointed as Professors in the War School.

Those Officers appointed to be Professors in the War School are generally Officers on the Staff. His Majesty has reserved their nomination to himself.

The Professors of the War School must be men of thorough experience and knowledge, and of high character in every respect, in order that their constant intercourse with the young Officers intrusted to their charge may exercise a healthy influence on their minds and morals. They must be perfectly conversant with all military matters, but they must possess especially a thorough and extended knowledge of the subjects they are appointed to teach, as well as the gift of oral instruction; they must continually strive to increase their knowledge and experience, and especially to penetrate further into their own particular branch of instruction, in order to be able, if occasion should call for it, to give written proofs of their proficiency.

Those Officers who wish to undertake a Professorship in the War School will be, in the first instance, appointed on probation. If the Director of the War School, after the year of probation is passed, is satisfied of the perfect fitness of the candidate, it will be announced to the War Department, upon which the aforesaid Officer and his servants will be transferred to the supernumerary list of their corps, and will be received into the War School. He will then only belong to his regiment as far as promotion is concerned, his payments being made to him as belonging to the War School.

The Officers appointed in the War School retain the rank they held in their Regiments they obtain their promotion in due course, and may not be passed over either in peace or war.

Captains of the first class, whether on active service or pensioned, after having been Professors for six years in one and the same appointment, enter on the enjoyment of double allowances, which they continue to receive as long as they hold the appointment.

In case of their passing upon the pension list or retired list, Officers appointed as Professors in the War School, after at least six years in the same, receive the rank of the next superior grade, and the pension attaching to that, as well as an extra personal allowance of 300 florins.

Section 13.

The teachers and masters who are civilians.

Civilians, as teachers and masters, are admitted at a rate of remuneration increasing 100 florins every six years, but without claim to a pension.

Section 14.

The rest of the officials.

For conducting the duties of the adjutancy and the general business (*manipulation*), the Director has under him an Adjutant, who has again as subordinate a person of good character, occupying at highest the rank of corporal, as clerk. The clerk, according to circumstances, may be chosen from such pupils of the School Companies as are least fitted for service in the field.

The servants and grooms are to be taken from the soldiers. They must be single men, of trustworthy character, and after having passed three months on trial, are transferred to the Corps of the War School.

Section 15.

"*Evident-haltung*" of the corps of the *Frequentanten*.

As the *Frequentanten* remain on the lists of their regiments, and are only temporarily ordered to the War School, no *Grundbuch* is kept concerning them.

At the end of October in every year the Position-list, drawn up according to Form No. 3., is to be laid before the Commander-in-Chief.

Section 16.

"*Evident-haltung*" of the teachers, inspectors, and servants; also of the horses.

The *Evident-haltung* of the persons who comprise the teachers, inspectors, and servants of the corps of the War School must correspond to the *Grundbuch* kept according to the general orders of the army. The most material object of this *Grundbuch* is the possibility of obtaining quick and important information concerning the nationality and service, as well of the effective strength as of those gone away; evidence of the proper performance of the appointed conditions both for entering and leaving, prevention of arbitrary dismissals before expiration of agreed upon term of service, and lastly, the possibility after an appointed time has passed to be able to destroy the attendance-lists and documents relating to position.

The *Grundbuch* must be in a bound volume, the quarto leaves of which are paged, and is to be kept according to Form No. 4.

In the *Grundbuch* shall be entered the whole account of birth, parentage, &c., together with all changes referring to these points, and to the description of service, as well as the person in question having had nobility or an order, a medal for bravery, or any other distinction conferred upon him, his marriage, the increase or diminution of his family; further, the amount of bounty already received, re-engagement money, equipment money, rewards for special service, charges for despatch of volunteers, also the deductions made on equipment monies and entrance fees, extracted from the documents themselves, with the respective orders upon those subjects.

As the *Grundbuch* is also kept with the War Office accounts, and the leaves detailing each new increase must be forwarded to that office, the size prescribed in the form must not be departed from. The *Grundbuch* must be renewed upon demand of this authority. The leaves referring to those who have quitted must be taken out, provided with an index, bound, and preserved for occasional reference. The remaining leaves, regarding the effective strength, are then to be numbered, and the new numbers, together with a catalogue of names, forwarded to the War Office accountant, that the *Grundbuch* may also there be arranged in a similar manner.

Respecting the horses of the scholars, the *Grundbuch* must be kept according to Form No. 5.

The Third Part.

The Pay and Dress of the Teachers, Inspectors, and Servants, also of the *Frequentanten*.

Section 17

Pay of the teachers, inspectors, and servants.

The pay of the teachers, inspectors, and servants is to be seen in Statement, No. 6. These salaries begin from the day the appointed individual enters upon his office, that is, before the time of probation has passed, with the exception of the allowance for equidment, which is first due when the time of probation is finished. During the mapping exercise, levelling, and reconnaissances, an extra allowance of 40 florins monthly is given to each of the Professors engaged. They have, however, no claim on the extra allowance for mapping and surveying, as also no extra pay is allowed to the Director when on his journies of inspection, his travelling expenses only being refunded.

Section 18.

Pay during treament in hospital.

The persons selected from the men for hospital service will discharge their duties in the War School without pay, while on the part of the hospital the allowance for household expenses and bread will be taken into account.

Section 19.

Dress of the Officers and of the Officials, from the Sergeant upwards.

The Officers on active service retain the uniform of the regiment to which they belong; the pensioned Officers are dressed like the Officers of the place (*Platz-Officieren*). The uniform of the Sergeants, Corporals, and Grooms is the same as the Dragoons, viz., light red facings and yellow buttons. The Sergeants and Corporals have to procure their own uniforms out of their allowance, for which purpose the equipment money specified in Supplement No. 6. is paid to them in quarterly instalments after their definite appointment, that is to say, when the three months of probation have passed. The uniform remains their own property.

The equipment money and uniform of the servants is the same as that of Officers' servants in the German infantry. It is delivered to them after completion of their probation from the Treasury, but it does not become their own property.

Section 20.

Pay of the *Frequentanten*.

The *Frequentanten* receive, besides their pay according to their respective rank in their regiments, the emoluments stated in Supplement No. 6.

During the mapping exercises, triangulation exercises, and at the reconnaissances, every *Frequentant* is apportioned an extra allowance of 30 florins monthly, as also his travelling expenses from Vienna to the first working station, and from the last working station to Vienna.

The labourers required for these works are to be procured from the nearest division of troops; they receive an extra allowance of 7 kreutzers daily, and the occasional allowance for wear and tear of equipment, at the cost of the Fund for Military Education.

APPENDIX Y.

Regulations of Austrian Staff School.

The Fourth Part.

The Instruction.

Section 21.

In general.

The knowledge which an Officer of the Staff must possess, in order to fulfil the duties of his position, is too multifarious to be made the subjects of instruction in its full extent. Education in the War School is chiefly intended to prepare the rising Officer of the Staff scientifically for his new vocation, and to indicate to him the ways and means by which he can carry on his own education in the best and shortest manner.

The subjects upon which instruction is given in the War School are to be found in Appendix No. 7.

Section 22.

The scientific instruction.

The instruction of the War School is given according to the prescribed plan of studies, and lasts from the 1st November to the end of September.

The plan contains the limits and boundaries of the subjects to be treated on, and points out generally to each Professor the substance which he has to work up and explain in detail.

The plan is open to any needful modification, which an advance in science or improvements in teaching may bring about; it also informs every teacher of those works and sources of assistance which are most useful in teaching, in order to lessen all arbitrariness and one-sided views in the choice of authors, and to avoid a change of Professors introducing an alteration in the system of instruction.

This arrangement has by no means for its object that the teacher shall strictly and unconditionally confine himself to the established principles, views, and favorite expressions of particular authors. The instruction shall, on the contrary, be free from all trammels of the schools, shall comprise an independent application of the generally acknowledged doctrines and principles of great generals and famous writers, and must be derived from a thorough knowledge of war and of its literature.

The combination of theory with practice, of the lesson with its application, must always be kept in view in instruction at the War School; elucidation by examples should, therefore, never be omitted, and education in all branches applying to the subject should not confine itself to instruction in the school-room, respecting which the plan of tuition must at every time contain particulars.

In order to penetrate deeper into the different branches of instruction, the *Frequentanten* of the War School have to work out in writing two larger problems monthly, especially from the higher Tactics, from the service of the Staff and Adjutancy, &c. These problems, to be alternately treated of in the French language, are to be then revised by the proper Professor, and laid before the Director of the War School, who by the aid of these is able to form an accurate judgment of the capabilities of the writer.

Section 23.

Scientific assistances.

The Professors of the War School, as also the *Frequentanten*, are permitted to have access to the Military Archives, as well as the other books, maps, documents, collections, and instruments belonging to the Staff, to the Military Geographical Institution, and to the other Military Establishments, taking care to observe the instructions issued for that purpose. Those objects alone which are constantly in use in the War School are to be obtained from the respective chief depots.

The War School receives a gratis copy of all maps, plans, and other works published in the Military Geographical Institution, and will be provided with other necessary copies at the lowest existing price.

The books, maps, and instruments which become the property of the War School, no matter how they may have been acquired, are to be carefully inventoried, and intrusted to the surveillance of one of the Professors, who is answerable for their existence and condition.

Section 24.

The riding lessons.

Particular attention is also to be paid to the riding lesson, and especial care to be taken that all the *Frequentanten* are mounted, as by this means alone they can in one year acquire that dexterity in riding requisite to command a battery or a squadron of horse.

Section 25.

The practical instruction.

The *Frequentanten* of the War School must practise the drilling of those descriptions of arms in which they have not served.

For this purpose, during the months of June, July, August, and September, they will be distributed among the different bodies of troops garrisoning Vienna, in order to join in their drilling and field exercise, and they will each year serve with a different arm.

At the close of these exercises the *Frequentanten* will have to take the independent command of a battery, of a squadron, and of a division of infantry.

In the month of May the *Frequentanten* of the first yearly course will undertake mapping exercises, and those of the second course reconnaissances, succeeded by searching out spots for encampment, the discovery, judgment, and description of points calculated for positions, têtes-de-pont, fortified camps, &c., with other occupations bearing upon the service of the Staff.

The *Frequentanten* are finally to attend as frequently as possible upon all experiments in military science undertaken at Vienna, upon which occasions the necessary explanations will be made to them by competent individuals.

Section 26.

Meeting of the Professors.

As often as may appear necessary, the Professors of the War School assemble, upon the summons of the Director, and under his presidency, for the purpose of discussing any subjects of material importance to the War School.

These discussions will be principally respecting the explanation of scientific questions, necessary alterations in or additions to the program of various subjects, division of the hours of instruction, &c.

The results of these discussions will in particular cases be laid before the Supreme War Department, especially if involving measures out of the province of the Director.

A protocol must be drawn up of every sitting, to be laid, if required, before the Supreme War Department.

Section 27.

Periodical reports.

At the end of April and September reports are to be made to the Supreme War Department respecting the progress of each separate *Frequentant* of the first yearly course. In these the Director of the War School must give a circumstantial account of the capabilities of each *Frequentant*, and state with the utmost conscientiousness whether he is fitted for the second yearly course.

For this purpose each Professor has to draw up a list of the whole body of *Frequentanten*, arranged according to the progress made by each in his subjects of study, and to designate briefly the capabilities and performances of each separately; this report of the Professors is to be added to the report of the Director.

Section 28.

The final examination.

The month of October is to be allowed as vacation time to the *Frequentanten* of the first course, while those of the second course undergo a *vivâ voce* and written examination upon every subject taught in the War School in presence of the Director and all the Professors, and under the inspection of the Chief of the Staff, or some other General appointed by the Supreme War Department.

The form of examination for each separate *Frequentant* is to be drawn up according to Section 6.

The final examination must commence upon the 1st of October and close at latest by the 10th. The whole number of reports of the examinations, together with the lists drawn up by the Professors according to Section 27, must be laid before the Supreme War Department by the 15th October.

The Fifth Part.

Departure of the *Frequentanten*.

Section 29.

Departure according to the regulations.

Upon the basis of the reports of the examinations, the Supreme War Department decides upon the promotion of the *Frequentanten* to the rank of First Lieutenants, if they do not already hold that rank, and this without regard to the former comparative rank of the students, as their final rank is determined solely and alone by the result of their studies.

The appointments of those destined for the staff or to return to their original arm are made at the same time.

Section 30.

Privileges of students who have passed the school.

All Officers who have passed through the War School successfully are always to have this circumstance notified upon their conduct list, individual descriptions, and similar documents. A special report is also to be handed in respecting them, during three years ending in October, by the Commandant of the Regiment, Battalion, &c., to the Supreme War Department.

APPENDIX Y.

Regulations of Austrian Staff School.

Those students in the War School who after passing the War School have again joined for service will be specially noted for promotion out of the usual turn after three years' service.

In time of peace only students who have passed the War School are to be placed upon the Staff or transferred to that corps. Should the number of these be insufficient to supply the demand, the appointments are to be either left vacant for a time, or according to the requirements of the service to be filled provisionally by Officers who will be replaced by students having passed the War School as the latter become available.

In time of war also, appointments becoming vacant on the Staff are to be filled up by students who have passed the War School, who are also to be chosen preferentially for extraordinary service, important commissions, journeys, for accompanying superior officers into foreign countries, and for similar purposes, in order that their knowledge may be enriched by experience, and that the costs which the State has incurred in their education may be as speedily as possible turned to account.

Section 31.

Removal of the *Frequentanten.*

As successfully passing the War School entails such considerable advantages, it is an indispensable principle that only those Officers be allowed to undergo the entire course who possess in every respect the requisite qualifications.

On this account, the reports mentioned in Section 27 must be drawn up with the utmost strictness and conscientiousness. Indulgence could nowhere be more misplaced than here, where such important interests are at stake.

Those *Frequentanten* who manifest during the course no striking capabilities, and even with the utmost industry are unable to attain the requisite success, must therefore be recommended by the Director to return to their regiments.

The Sixth Part.

Leave of Absence allowed to the Teachers and the *Frequentanten.*

Section 32.

Leave of Absence.

Leave of absence for the teachers is, as a rule, only permitted during the time not devoted to instruction, and then the Director will give the necessary permission without deduction of their respective payments.

Leave of absence during the course can only be permitted in cases of the utmost necessity, for which purpose the assent of the Supreme War Department must be obtained. The *Frequentanten* of the first yearly course may receive leave of absence during the month of October from the Director, in which case their allowances are continued.

In cases of illness, leave of absence will be allowed to the officials of the War School, as well as to the *Frequentanten*, even during the course, in accordance with the rules of the Army.

The Seventh Part.

Control of the War School.

Section 33.

Control.

The War School is an independent institution, directly subject to the Supreme War Department.

Besides the already-mentioned periodical reports, the individual descriptions and conduct lists of the teachers and inspectors are, upon the 15th December in every year, to be sent in duplicate to the Section of the War Department for military educational institutions.

Simultaneously with the presentation of the reports of the examination appointed in Section 28, the Director must give to the Supreme War Department a comprehensive report of the capabilities and performances of the Professors.

The War School is in matters of jurisdiction subordinate to the First Section of the War Department, and in Civil Cases to the Judicium Delegatum Militare.

The remaining Sections are occupied with minute directions as to household and financial management.

APPENDIX Z.

LIST OF TEXT BOOKS, AUTHORIZED BY THE GOVERNMENT, FOR USE IN THE MILITARY SCHOOLS IN AUSTRIA,

(COPIES OF WHICH WERE PRESENTED TO THE COMMISSION BY THE FOURTH SECTION OF THE WAR DEPARTMENT).

1. Arithmetic (*Lehrbuch der Arithmetik*) for the First Yearly Course in the Cadet Schools, by Major Hembyze, Professor of Mathematics and Physics at the Wiener-Neustadt Academy. Vienna, 1853.

2. Arithmetic and Algebra (*Lehrbuch der Arithmetik und Algebra*) for the Second Yearly Course of the Cadet Schools, by the same Author. Vienna, 1854.

3. Arithmetic and Algebra (*Lehrbuch der Arithmetik und Algebra*) for the Third Yearly Course of the Cadet Schools, and for the Scientific School Companies, by the same Author. Vienna, 1855.

4. The Geography of the Austrian Empire (*Lerbuch der Geographie des Osterreichischen Kaiserstaates*) for the use of the School Companies. Vienna, 1855.

5. Sketches of the Law of Nations as at present recognized in Europe (*Grundriss des heutigen Europäischen Völkerrechtes*) for the use of the Military Academies, by Dr. L. Neumann, Professor of Law at the University of Vienna. Vienna, 1855.

6. Elements of Austrian Civil Law (*Lehrbuch des Osterreichischen positiven Privatrechtes*) for the use of the Military Academies. Vienna, 1856.

7. Rules and Regulations for the Service of a Company (*Compagnie-Dienst-Reglement*), for the use of the Institutions for Military Education. Vienna, 1855.

8. Outlines for Instruction in the Composition of Military Papers, and in the Management of the Affairs of the Subdivisions of the Imperial Army (*Leitfaden für den Unterricht in den Militärrischen Aufsätzen und in der administrativen Manipulation bei der Unterabtheilungen der kais. kön. Armee*), for the use of the School Companies. Vienna, 1855.

9. Supplement (*Beilage*) to the above (containing examples, &c.) Vienna, 1855.

10. Outlines for Instruction in the Administration of the Military Frontiers (*Leitfaden für den Unterricht in der Militär-Grenz-Verfassung*), for the use of the Frontier School Companies. (2 volumes.) Vienna, 1855.

11. Outlines for Instruction in Staff-fencing (*Leitfaden fur den Unterricht im Stockfechten*), for the use of the Institutions for Military Education. Vienna, 1854.

APPENDIX A a.

REGULATIONS OF THE RUSSIAN STAFF SCHOOL*.

FIRST CHAPTER.

General Directions.

1. *Object.*

A Military Academy is founded in St. Petersburg, by the side of (*bei*) the General Staff of His Imperial Majesty, to educate Officers for the service of the General Staff, and to promote the diffusion of Military Science in general.

2. *Functions.*

Accordingly, it is the Function of the Academy,—

1. To prepare Officers for the special Service of the General Staff.
2. To furnish to a certain number of Officers from the Artillery and Chief Engineer School a course of Grand Tactics and Strategy, on the same principles and to the same extent as it is furnished to the Officers preparing for the Service of the General Staff.
3. To apply all the means indicated in these Regulations to the diffusion of Military Science.

3. *Number of Students.*

From forty to fifty Officers shall be educated in the Academy for the special service of the General Staff, and about ten from the Artillery and from the Chief Engineer School.

4. *Title.*

The Military Academy, as the highest Institution for Military Education, has the title of "Imperial."

5. *Head.*

The Military Academy is under the immediate control of the Chief of the Staff of His Imperial Majesty, and is under the direction of a President appointed by the Emperor.

6. *Council.*

A Council, presided over by the President, considers and determines all important questions relating to Studies and Economic Administration.

7. *Vice-President.*

A Vice-President, appointed by the Emperor, is associated with the President to assist him in the performance of his official duties.

8. *Control of the Students.*

The Officers receiving an education for the General Staff are placed under the control of four Staff Officers appointed by the Emperor.

9. *Two Sections.*

The subjects of Study and the Scientific Course are divided into two Sections, the Theoretical and the Practical.

10. *Professors.*

The number of Professors, Adjuncts, and Teachers is determined according to circumstances by the Academic Council, with the approbation of the Chief of the Staff of his Imperial Majesty.

11. *Salaries.*

The Salaries of the Officials for the internal service of the Academy are fixed in the List annexed to these Statutes.

* These were obtained at the Fourth (or Educational) Section of the War Office at Vienna.

12. *Duties of the Superiors.*

It is the most sacred duty of the whole Staff of the Academy, and in particular of the Chiefs and Professors, never to lose sight of its object; and while they devote themselves to extend the knowledge of the student Officers, to impress upon them, by teaching and example, the precepts of the purest morality, the true and exact performance of their professional duties, an unconditional obedience to their superiors, and an inviolable devotion to the throne and their country.

13. *Seal.*

The Academy has a peculiar Seal, with the inscription ——— (in Russian).

14.

SECOND CHAPTER.

Admission of Students.

15.

Only Superior Officers (*Ober-offiziere,*) can enter into the Academy, and these up to the rank of Staff Captain if they serve in the Guards, Artillery, or Engineers; up to the rank of Captain, if they belong to an Army Regiment.

16.

The Directors of the Noble Guard School, of the Page Corps, of the First, Second, Pant, Moscow, and Finland Cadet Corps, have the right to propose in the proper quarter, for admission into the Academy, the most distinguished Officers who have left these military institutions.

17.

The Officers proposed for admission into the Academy must be at least eighteen years old, and be distinguished for capacity, industry, diligence, morals, and good conduct.

18.

Officers from the Regiments and Artillery Brigades must present testimonials of blameless morals, conduct, and zeal for the Service from the Chief of their Division. Officers from the Engineer Battalions must present similar testimonials from the Chiefs of their Brigades.

19.

Those who give testimonials are strictly responsible for their truth, as are the Chiefs of the Military Schools for the capacity and qualifications of the Officers they propose.

20.

Admission into the Academy depends upon a strict examination in the following subjects:—

a. Languages:
Russian, German, or French.

b Mathematics:
Arithmetic, Algebra to Equations of the Second Degree, Plane and Solid Geometry, and Plane Trigonometry.

c. Military Sciences:
The Principles of Intrenchment, Fortification, and Artillery.

d. Evolution:
Evolutions of a Battalion of Tirailleurs, of a Squadron, of a Whole Line, of a Scattered Front (*Zerstreuten Fronte*), and, lastly, the Service of Outposts.

e. History:
General History of the World to the sixteenth century in its chief epochs, particularly in reference to Russia; special Histories of the European States in modern times.

f. Geography:
Universal Geography, and particularly that of the Russian Empire and the neighbouring States.

Besides this, a clear conception of Situation, Plans, and Topographical Charts is required.

APPENDIX A 2.

Regulations of Russian StaffSchools.

THIRD CHAPTER.

Method of Instruction.

21.

The Scientific Course is divided into two Sections,—the Theoretical and the Practical The Theoretical part of the higher Military Sciences is expounded by the Professors, their Adjuncts, and the Teachers. Those Officers who belong to the Practical Section exercise themselves under the guidance of the Professors;

a. In Written Exercises on any proposed Military Subject.

b. In the composition of Military Descriptions (*Beschreibungen,*) of every kind.

c. In the Art of taking Military Surveys of a Country, and of judging the Tactical Nature of a Ground.

22.

In each Section there are from twenty to twenty-five Officers destined for the Service of the General Staff, and from four to five from the Artillery and Chief Engineer School.

23.

These Officers, according to their capacities and attainments in the Military Sciences, enter either into the Theoretical Section or into both the Theoretical and the Practical Section at the same time, and remain in each a year.

24.

The complete Academic Course in both Sections extends over two years.

25.

The following subjects are taught:—

a. Russian literature, with particular reference to the composition of Military Essays in a faultless style, and to the style of the Military Chancery (writing department of the War Office).

b. General ideas on Artillery, and more precise details on the same subject as a Special Arm; its use in the open field and in sieges.

c. Petty Tactics in the employment of a single Division, with which all Officers must be thoroughly familiar, as this is indispensable to all. To this is joined the theory of the formation of olumns, of their use, of the effect of the fire of Infantry, and lastly, the explanation of all evolutions with the three arms which are usually employed for movement, deployment, or forming in order of battle.

d. The Elements of Topography and Geodesy, of Military Drawing, and the art of measuring situations by the eye.

e. Military coup d'œil (*Scharfblick*), and the art of judging the tactical nature of ground.

f. Castrametation, or the art of encamping, and the theory of positions.

g. Logistic, or all that relates to the details of marches, either in presence of the enemy, or in the movement of troops from one place to another.

h. Intrenchment and fortification, as far as regards the attack and defence of intrenched camps and fortified places, and the effect of intrenchments and fortifications on the operations of an active army.

i. Grand Tactics, embracing the various systems of the Order of Battle; and the formation and employment of the Three Arms, and treating of unexpected engagements or the sudden collision of two hostile Divisions.

k. The Military Geography of Europe, particularly that of the Russian Empire and the neighbouring States.

l. Military Statistics, or knowledge of the land and sea Forces and warlike means of all the European States.

m. Strategy in all its extent; with a criticism on the last wars, and an indication of the events which demonstrate the influence of this science on the success of a campaign.

n. A general view of military history in its most remarkable periods, from the earliest times to Peter the Great, and a more complete view of the Military History of modern times.

o. The literary History of the Military Sciences, with a criticism on the best ancient and modern writers on the History of War; and a special reference of those who may contribute to the further education of the Officers after their departure from the Academy.

p. Duties of the General Staff Officer in times both of peace and war.

q. The art of riding.

26.

The Officers of the Practical Division are employed on the same Sciences; not, however during the hours of lecture, but by practising under the direction of the Professors, and according to the regulations of the Academic authorities.

27.

The subjects they are employed upon are principally the following:—

a. Topographical and Tactical description of ground after inspection.
b. Military Geography and Statistics.
c. Logistic.
d. Grand Tactics.
e. Strategy.
f. Military History.
g. Literature of the Military Sciences.
h. Designing plans of battles and manœuvres, as exercises in Topography, Logistic, and Tactics.
i. Historic reports, and keeping the usual journal of the General Staff.
k. All that belong to the survey of a country, and the practical working of the Artillery and Siege operations.

28.

Teachers are appointed for those Officers who require to be perfected in the French or German language.

29.

All the sciences are taught in the Academy in the Russian language; and an exposition in French or German is only allowed when dictated by circumstances, and then a special permission must be first obtained from the Chief of the Staff of his Imperial Majesty.

The Officers of the Practical Section are also required to use their native tongue in their written exercises, except in one or two composed in a foreign language by the direction of the authorities.

30.

In summer the Officers of the Theoretical Section repair to regiments to which they are directed to learn the camp service. The Officers of the Practical Section make surveys and reconnaissances, mark out camps and proportionate intrenchments on a given ground. At the time of grand manœuvres, they are associated with Officers of the General Staff, and have the opportunity of witnessing the practical exercises of the Artillery and Sappers, in order to be able to make a report as eye-witnesses on the effect of Artillery and Siege operations.

FOURTH CHAPTER.

31.

All Officers receiving an education in the Academy are entered on the rolls of their Regiments, Artillery Brigades, and Sapper Battalions, as supernumeraries and detached Officers, without, however, losing their standing or right of promotion by seniority, their pay, servants' rations, or any other advantages enjoyed by Officers present with their troop.

32.

Those Officers who enter the Academy from the Regiments of the Garrison of St. Petersburg continue, while they belong to it, to perform the front service of their Regiments; those who come from the Artillery and Sapper Brigades, or from Regiments not stationed in St. Petersburg, are attached for the front service to one of the Regiments of the Garrison of St. Petersburg; the necessary arrangements are made by the authorities of the Guard Corps.

33.

The Officers of the Artillery and Chief Engineer School, having only to attend the Course of Grand Tactics and Strategy, retain their posts while studying in the Academy.

34.

Four Staff Officers, appointed by the Emperor, have the immediate control of the Officers preparing themselves for the service of the General Staff; they are to exercise a vigilant supervision over them, and to report on their conduct to the Vice-President; they are the organ by which all orders reach the Officers, and they form a Court of the First Instance in matters relating to the Service.

35.

One day in the week is devoted to drill, and every day two Officers mount guard with the first division of the garrison of St. Petersburg.

36.

The Officers are to devote exclusively to study the leisure hours at their command after the performance of front and garrison duties; and are to observe, in all respects, the Statutes of the Academy.

37.

To facilitate, economically, the residence of the Officers in St. Petersburg, they receive, with the exception of those belonging to the Guard, besides their usual pay and an allowance for quarters according to their rank, an annual allowance of 500 roubles, which is paid in the Academy.

38.

Officers ordered to survey a country, or to make a reconnaissance, receive their travelling expenses from the Commissariat, according to the distance to which they are sent, and in proportion to their rank: their board expenses are not allowed.

FIFTH CHAPTER.

39.

The course is terminated, and Students finish their career, in October annually.

40.

At the same time Officers are removed from the Theoretical section to the Practical, making place for candidates who wish to enter the former.

41.

At their departure from the Academy, the Officers receive from the Academic Council testimonials of conduct and scientific attainments, with a memorial of the rewards which they receive at leaving.

42.

On leaving the Academy the Officers have to act as follows: those who belonged to the Artillery, or Chief Engineer School, repair to their highest Commanding Officer; the rest, who were educated for the service of the General Staff, return to their Regiments, Artillery Brigades, or Sapper Battalions, on whose rolls they remain as supernumeraries and Officers reckoned as of the General Staff, until they are formally transferred to the latter, which takes place according to the regulations in Article 45.

43.

The rewards to which Officers can acquire a claim at leaving the Academy are the following:—The most distinguished is promoted to the lowest rank (on the Staff), and receives a golden medal; he is only entitled to this if all the teachers give him the full number of balls and unanimously recognise him as most conspicuous for attainments. Besides this, he must have written a satisfactory essay on a given theme, relating to some important war, and have been blameless in moral conduct during his residence in the Academy. The student who is recognised as second, both in attainments and behaviour, and has also obtained the full number of balls, is rewarded with the great silver medal, and receives double pay for a year. The student who obtains the third place in attainments and behaviour, and the full number of balls, receives the little silver medal, and double pay for a year. Each medal bears the name of its possessor. Besides this, the names of all those who obtain one of the three above-mentioned rewards are engraved on marble tablets, which adorn the walls of one of the halls of the Academic building.

44.

Should any of the Students feel no inclination for the service of the General Staff, even after a successful termination of the Theoretical Course, he may always request to be dismissed to his Regiment, Artillery Brigade, or Sapper Battalion.

45.

Every Officer who at his departure from the Academy obtains a testimonial of having accomplished the object of his admission, and in consequence is provisionally destined for the service of the General Staff, if he continues after his return to his Regiment to educate himself for his vocation, and distinguishes himself by observance of a strict dis-

cipline, by conduct and zeal for the service, is rewarded at the end of a year by being completely transferred to the General Staff; and if he belonged to the Young Guard, the Artillery, or a Sapper Battalion, his right to promotion immediately commences; not so if he belonged to Troops of the Line.

46.

Every Officer who is reckoned as of the General Staff, when he is employed on its duties in the way described in Article 50, wears during such employment shoulder bands of the colour of the buttons of his uniform.

47.

Every year on the 1st of January the Chief of the Regiment, Artillery Brigade, or Sapper Battalion in command of an Officer reckoned as of the General Staff, forwards his form and his conduct list to the Quartermaster-General of the General Staff, who lays it before the Chief of the General Staff. At the same time the above-mentioned papers are communicated to the Chief in command of the Officer.

48.

Besides this, the above-mentioned Chief makes a similar report on the zeal for the service and moral conduct of the Officers twice a year, namely, on the 1st of March and the 1st of September; and at the same time reports exactly on the way in which he performs the service of the front.

49.

No Officer reckoned as of the General Staff is to be charged with the duties of Paymaster service in his Regiment, or employed as Quartermaster; and if any General wishes to select him for his Adjutant, he must first communicate with the Quartermaster-General of the General Staff.

50.

If the General Staff is increased in time of war, or if any work on which it is employed requires to be accelerated in time of peace, the Chief of the General Staff commissions the Quartermaster-General to select the requisite number out of the Officers who are reckoned as of the General Staff. The latter then makes the selection, and announces the names of the Officers selected to their highest Commanding Officer. As soon as the object proposed is accomplished, these Officers return back to their commands. Such a selection, however, can only fall upon those who have spent at least two years with their commands after their departure from the Academy. If in the meantime an Officer has become Chief of a Battalion or Squadron, he shall not be transferred from this post before the lapse of a year. As soon as any of these Officers, or, in general, any Officer, who has left the Academy, reports himself at his Corps, his Chief immediately announces his arrival to the Quartermaster-General of the Staff.

51.

To familiarize the Officers reckoned of the General Staff with the rules of the Art of War while they remain with their commands, and to practise them in the duties which belong to Officers of the General Staff, the Quartermaster-General is directed to charge them with such duties as may develop their talent, without, however, removing them for that purpose from the service of the front. These commissions of the Quartermaster-General are communicated through their superior Officers, who are directed not only to watch over their performance of these commissions, but also to assist them therein to the utmost of their power.

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